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KIDDER'S GUIDE

TO

APIARIAN SCIENCE,

BEING A

PRACTICAL TREATISE,

IN EVERY DEPARTMENT OF

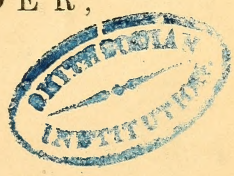
BEE CULTURE AND BEE MANAGEMENT.

EMBRACING

THE NATURAL HISTORY OF THE BEE, FROM THE EARLIEST PERIOD OF THE WORLD, DOWN TO THE PRESENT TIME; GIVING THE ANATOMY AND PHYSIOLOGY OF THE DIFFERENT SPECIES OF BEES THAT CONSTITUTE A COLONY, &c.

BY K. P. KIDDER,

PRACTICAL APIARIAN.



BURLINGTON, VT.

SAMUEL B. NICHOLS, 146 CHURCH STREET.

Chicago—RUFUS BLANCHARD, 52 LA SALLE STREET.

1858.

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KIDDER'S GUIDE



TO

APIARIAN SCIENCE



Entered according to Act of Congress, in the year 1858, by
K. P. KIDDER,
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BEE TRAINING.

Introduction of a New System of Bee Management,

BY K. P. KIDDER.

I am well aware that the public have been grossly deceived, and many times swindled out of much money, in the purchase of Patent Bee Hives which, in many instances, have been more of a curse than a profit, in Apiarian pursuits. It is absolutely necessary for the bee-keeper to have a partial knowledge of the instincts and habits of bees, before he will be able to manage and train them successfully. Bees have been kept for hundreds of years. We have knowledge and the history of them for more than 2200 years, and that they were then kept with success among the most scientific historians; although there have been many and useful improvements made since that time. If the bee-keeper will follow the directions laid down in this circular and book, he can keep, handle and train bees with success. The time has come when, through the knowledge and experience of the Author, a complete revolution will take place in the management and culture of the honey bee, as all difficulties that have heretofore pertained to bees have been successfully overcome. When we can be profited by the experience of men who have spent almost their whole lives in the culture of the bee; in performing their many costly experiments, watching their movements through a glass hive until blindness was the result, which has been the case with some of our most celebrated naturalists. We know that much depends, in the culture and management of bees, upon the kind of hive the Apiarian makes use of. I am aware there are hundreds

of hives now in use, of different kinds, and some of them are better adapted for bees to die in than to flourish and live. I have used many kinds of hives, in the course of my apiarian pursuits, and have invented several hives within a few years. I have sought and aimed to have a hive so constructed that it would meet the demands of the bees, as well as the convenience of their owner. My last improvement, I think, will come as near to perfection as any hive now patented, and for general use and practicability, it has no superior. I will almost challenge the World to produce a hive that will equal it in every department of bee culture and management. I will here give the reader a few of the advantages this hive possesses over the generality of hives :

1. It is more condensed and takes up less room, considering its capacity, than any other hive.

2. It can be opened any season of the year without annoying the bees in the least.

3. The combs, honey and bees can be taken out of the hive at any season of the year, and put back again, and the hive brushed out if desired, in five minutes time.

4. It is a swarming, or a non-swarming hive ; it is a good summer as well as a winter hive ; one hive, or two hives, at the option of the Apiarian. See Chapter on Hives, in Book, for a full description of it.

5. When in winter quarters, there is a dead air space encircling the whole colony, and such a thing as frost and ice cannot enter, when occupied properly, as is the case with other hives.

6. It is one of the best hives in use for feeding bees, as it can be done safely anytime of the year, and no other colony will know of it.

7. It will winter bees well, either out of doors or in the house.

8. The honey can be made in cards weighing from six to eight pounds each, or in boxes, tumblers or any other receptacle the bee-keeper chooses.

9. It will enable the bee-master to multiply his colonies rapidly, or compel them to make honey instead of breeding.

10. The Apiarian can take the best part of the honey from the hive, and supply the deficiency by an inferior article for the bees' winter use.

11. It will allow the bee-master to double or treble his bees any time he chooses, or divide a swarm and make two of it any time in the honey season.

12. The comb can be furnished to the bees from other hives, should the Apiarian have spare comb.

13. It can be transported from place to place by stage, steamboat or other conveyance. It also furnishes the greatest possible security against the ravages of the bee-moth.

14. Drones can be prevented from hatching, or killed off in a day or two, should there be any in the hive.

15. When a colony have lost their Queen they can be supplied with another one. The Queen can be caught in three minutes, any time, and should there not be a Queen, it can be ascertained in the same length of time,

16. The bee-master can swarm his bees artificially, or let them swarm naturally. The bees can be prevented from running away after a swarm is hived in it. The drone-killer, or regulator, will prevent bees from robbing, generally, and my newly invented bee-catcher will prevent robbing, effectually, as the bee-master can catch every bee that troubles his hive, or take a swarm of bees from a tree and not know where the tree is situated. Should the reader have any doubt of the truth of these statements, let him call upon the Inventor, and be satisfied of the fact that these assertions are true, in every respect.

The question is often asked, how many pounds of honey a swarm of bees will make in one season. As so much depends upon circumstances, it is rather a hard question to answer, but I will endeavor to answer it. If it is a large, healthy swarm, commence in the spring by giving them a non-swarming hive, to prevent there being any drones, (the male bee, which never makes a drop of honey, but consumes it rapidly,) and if it is a good season for bees and proper care and attention are bestowed upon them, they will make nearly three hundred pounds of honey. I have a colony that has made upwards of two hundred pounds this year, 1858, by giving them a non-swarming hive, and without any extra care and attention. It is almost incredible how fast bees will make honey, when everything is favorable. I have had them store up ten or twelve pounds in a day. We have information showing that they have made as high as eighteen pounds in one day.

By this system of management, bees, comb, and all, can be removed any month in the year, from the common hive to my compound hive. (See book for particulars.) The transfer can be made by any person, in 30 or 40 minutes, after reading the directions.

Persons whose bees do not prosper or do well, can, by calling on or writing to the subscriber, have them examined, and the trouble, whatever it may be, rectified.

This hive is very simple in its construction, and any one can build them if they only have the necessary tools. Our agent will call on the different bee-keepers in the country, as soon as practicable; the price of the non-swarming hive complete, will be $7,50; the price of the single or swarming hive, will be $6,00. The price of an Individual Right to make and use for himself exclusively, will be $5,00, but if the hive and right are purchased together, for the double hive $11,00, and for the single hive and right, $10,00. Most peo-

ple prefer the whole, as then they will be entitled to a fine drawing of the whole thing, with directions and measurements for their manufacture.

We also have Glass Hives that are adapted to a store, office, or parlor. These, with the right to manufacture for private or individual purposes, will be $12,00; State, County, and Township Rights, for sale at reasonable prices. Gentlemen, particularly those from the country, are requested to accept of a few of the circulars for distribution in their respective neighborhoods,

The reader will please preserve this circular and after reading pass it to his neighbor. All persons interested in the culture of the honey bee, would find it greatly to their advantage to purchase the book, (Kidder's Guide to Apiarian science,) which contains nearly 175 pages, and is a complete guide to bee-keepers in all the various departments of bee-culture. Price 50 cents; if sent by mail, the postage, (seven cents) will be added. The publishers and author can furnish the books at wholesale or retail, if desired; a liberal discount to the trade. The price of the full bound book is 75 cents; when sent by mail, including postage, 87 cents, or 29 postage stamps. All money or stamps at our risk if the letter is registered.

The inventor of these hives is now making arrangements to issue a Monthly Bee Journal, each number to contain 32 pages, and embellished with numerous engravings. It will be devoted exclusively to the Honey Bee and its Culture and Management. The terms of subscription will be $1,00 per annum, payable on receipt of the first number. It will be edited and conducted by a gentleman who is thoroughly posted up in Entomology in all its various branches. The proprietor will spare no pains to have the Journal got up in a way and manner that will command respect and patronage generally.

The proprietor is well aware that a Journal of this character is very much needed at the present time, as there is not one published in the United States, although there are several in Germany, France, and England. This is a deplorable state of affairs, and we trust the time is not far distant when Bee Culture will be far in advance of what it now is. Persons wishing to subscribe for this Journal, will please forward their names immediately, and as soon as published a sample copy will be sent them, and should it meet their approbation they can remit one dollar.

All communications should be directed to K. P. KIDDER, care of the *Times Office*, Burlington, Vt.

CONTENTS OF BOOK.

It will teach the Apiarian how to manage his bees; how to train them; how to make them breed rapidly; how to make them produce honey; how to make them swarm; how to prevent their swarming; how to keep them through the winter safely; how to make them healthy; how to prevent their getting diseased; how to keep them until they die with old age; how to ascertain the age of the different kind of bees in a colony; also, the physiology, anatomy, and history of bees from the earliest period of the world; also, giving the habits and instincts of bees. The bee-keeper will learn how to put two or more swarms together any time he chooses; how to divide a swarm into two or more; how to prevent bees from leaving the hive after they have been put into them, (when they have swarmed naturally); how the loss of the Queen can be supplied and save the stock; how the bee-keeper can ascertain when there is a fertile Queen present; how the Drones can be killed off, and how they can be prevented from hatching; how to make bees work in any kind of receptacle, such as

boxes, decanters, tumblers, &c.; how to keep bees. summer and winter, out doors and in; how to prevent bees from stinging; how to make wax from old combs; how to feed bees safely any time of the year; how to change bees from one hive to another any time of the year; how a fortune can be made by keeping bees, and what the required means are; how bees can make 15 and 18 pounds of honey in one day, and two and three hundred pounds in a single year; how to transport bees from one place to another; how to keep bees from robbing; how to break up their robbing when once commenced; how to drive bees into a hive when they are all over the outside of it; and many more things I might mention if time and space would permit of it. I regret very much that I have been so limited in this respect, as many things have been omitted that would be of much use to the practical Apiarian. All orders promptly attended to.

Mead. Some persons may feel desirous of making for themselves this once famous drink. I will attempt to furnish them with simple directions for so doing: Common Mead is formed by mixing two parts of water to one of honey, and boiling them together and taking off the scum.

Fermented Mead, is formed of three parts of water to one of honey, boiled as before, and skimmed and casked. The cask is to be left with the bung out and exposed to the sun, or in a warm room, until it ceases to work. The bung should then be replaced and in about three months it is fit for use. The addition of a fermenter is of course necessary, taking care that it be sound, good and sweet. Hops are an improvement to Mead, as it takes from its sweetness; also, chopped raisins boiled with it at the rate of six pounds of honey to each half pound of raisins, also, a few bits of lemon peel, and a few glasses of brandy will improve it very much.

Metheglin, is only another name for Mead, altered by the addition of various ingredients, according to taste; these

liquors may be refined and bottled like other wines, and will if properly managed, keep for years.

Artificiat Honey, which can hardly be distidguish from the pure article, is made as follows : Take of soft water six pounds, best moist brown sugar 20 pounds, pure bees honey 3 pounds, cream of tartar 80 grains, essence of roses 20 drops ; mix in a brass kettle, boil five minutes and then take it off and add the white of two eggs well beaten ; when almost cold add two pounds more of pure honey. A decoction of slipperry elm bark, or the mucilage of gum Arabic, will improve the honey if added while cooling ; sometimes starch is used instead of the bark or gum, and is very good.

Letters on business must be addressed to K. P. KIDDER, Burlington Vt.



Drone.



Queen.



Worker.

PREFACE.

Having spent several years in the study of the Honey Bee, (*Apis Mellifica*) and knowing there are but few books published in this country upon that subject, which are practical works for the Apiarian to be guided by, and seeing so much mismanagement with bees, and knowing the profits to be derived from their keeping when they have proper care and attention bestowed upon them, has induced me to write this small treatise.

In all countries and in every age, the labors of bees has proved a fertile source of admiration, and mankind have endeavored unremittingly to convert it to gratification or emolument. What can be more wonderful indeed, than to witness an insect of such apparent insignificance, rendering each different flower tributary to itself, or the necessity of its young; and fabricating structures which no human art can approach and imitate. But it is from the impulse of its propensities, and from the united efforts of myriads, that we are enabled to gain those valuable products which otherwise would be utterly unattainable. Curiosity and avidity being equally awakened by the industry of these diminutive beings, innumerable theories, observations, and experiments, have followed, regarding them; yet the real discoveries compared with the investigators, has been surprisingly few. Vague speculations have been substituted for rational researches into the nature of bees, and superficial inspection deemed satisfactory analysis of their works. Hence the properties actually ascertained, are so interwoven with error, that no subject has been the parent of greater absurdities. Unfortunately, also, some of these treaties, and the most accessible ones at the present day, only con-

tribute to their wide dispersion and enhance the difficulties of the philosophical naturalist who is attempting their eradication. A considerable portion of this work is devoted to this purpose ; it belongs to the reader to judge of the deductions whereby the author concludes that he has established many facts from experiments. Perhaps no treatise of equal compass, or even greater, contains as many novelties in the history of bees. Their nature, organization, sense, instinct, and mode of perpetuation, are all illustrated. The origin of Wax, the faculty of obtaining it from honey or sugar, its application to use in the structure of cells and the formation of comb, are fully discussed, while several points are established which had been previously, themes of conjecture and controversy. But the general approbation given here, as well as in many parts of the Old world, to a modest and unobtrusive work, wherein both instruction and amusement are combined, constitutes the best testimony of its merits. Thus, to use the words of Sue, an eminent foreign author, "the observations are so *consistent*, and the deductions so *conclusive*, that this treatise will be a guide to Apiarian science, in all its various departments." It has been the aim of the author in this small treatise, to give to the world a system of Bee Management that will prove a guide to Apiarians and a benefit to the rising generation.

K. P. KIDDER, Burlington Vt.

MEMOIRS OF HUBER,

PRINCE OF APIARIANS.

The Naturalist whose researches have been specially directed to the instincts and operations of the domestic Honey Bee, will be strongly disposed to regard the subject of this Memoir, as at the very head of Apiarian Science, and his writings, as forming the safest and most useful text-book. Multitudes have written on this interesting department of Natural History, and have added more or less to our knowledge of what has been a subject of investigation for ages. But none, either in ancient or modern times, have displayed so much sagacity of research, as FRANCIS HUBER, nor so much perseverance and accuracy of experiment, even admitting some errors of minor importance, detected by succeeding observers. His success in discovery, notwithstanding the singular difficulty he had to struggle with, was proportioned to his intelligence and acuteness; and this difficulty arose, not from what some of his advocates have, in their zeal in his defence against the sneers of the skeptical, termed "imperfect vision," but from total blindness. For, from the period when he first applied himself in good earnest, to investigate the nature of his winged favorites, external nature presented to his eyes one universal blank.

It is not, therefore, without reason, that his friend and eulogist, *De Candole*,* asserts that "nothing of importance has been added to the history of Bees since his time; and naturalists of unimpaired vision, have nothing of consequence to subjoin, of a brother who was deprived of sight."

Francis Huber was born at Geneva, on the 2d of July, 1750. His father possessed a decided taste for subjects of natural science; the son inherited the taste of his father, and even in his boyish days, pursued his favorite studies with such intense ardor, as materially to injure his health, and bring on that weakness of his visual organs which, eventually, ended in total blindness. His attention had been led to what became his sole and engrossing study, the habits and economy of the Honey Bee, by his admiration of the writings of Reaumur, and above all, by acquaintance with Bonnett, the illustrious author of "*Contemplation de La Nature*," who quickly discovered the intelligence and penetration of his young friend; and who kindly and strongly encouraged him, in his peculiar researches. It is singular enough, that these two distinguished naturalists and friends should both have labored under a similar personal defect, occasioned, too, by the same causes; for the same intenseness and minuteness of observation which deprived Huber of sight altogether, had brought on in Bonnett a weakness of vision, which, for a time, threatened total blindness, and from which he never fully recovered.

It will readily occur to every one that the loss of sight in Huber, must not only have presented a very serious obstacle to the successful study of his favorite science, but must have had the effect also, of throwing considerable doubt on the accuracy of his experiments, and the reality of his discoveries. His most devoted admirers, and most unhesitating followers,

*See Memoirs of Huber by M. de Candole, in the Edinburgh Philosophical Journal, for April, 1833.

in every thing connected with the economy of Bees, are bound in candor to acknowledge, that his observations, reported as they were at second hand, and depending, for their accuracy, on the intelligence and fidelity of a half-educated assistant, were, of themselves, not entitled to be received without caution and distrust. Francis Burnens, his assistant, had, no doubt, entered with enthusiasm into the pursuit, and appears to have conducted the experiments not only with the most patient assiduity, but with great address and no small share of steadiness and courage; qualities indispensable in those who take liberties with the irritable *genus apum*. Still, Burnens was but an uncultivated peasant when he became Huber's hired servant, and possessed none of those acquired accomplishments which serve to sharpen the intellectual faculties, and fit the mind for observing and discriminating with correctness.

It cannot reasonably excite our wonder, therefore, that on the first appearance of Huber's observations, the literary, or rather the scientific, world was somewhat startled, not only at the discoveries, but also at the instrumentality by which they had been effected.

Huber, however, had taken great pains in cultivating the naturally acute mind of the young man, in directing his researches, and accustoming him to rigorous accuracy in his observations. And the fact that a glimmering of many of the discoveries reported by the assistant to his master, had presented themselves to the minds of Linnæus, Reaumur, and other preceding observers, should so far satisfy us that they were not brought forward merely to support a preconceived Theory, (of which, it is probable, Burnens had no idea,) nor owed their origin to a vivid and exhuberant imagination. At a future period, Huber was deprived of the aid of this valuable coadjutor; but the loss was more than compensated, and accuracy in experiments and observation, if possible, still

more unquestionably secured, by the assistance and co-operation of his son, P. Huber, who has given so much delight to the lovers of Natural History, by his "Researches concerning the Habits of Ants."

But whatever hesitation may arise in our minds from the fact of Huber's discoveries not being the result of his personal observation, no doubt can reasonably remain, as to such of them as have been repeatedly confirmed and verified by subsequent observers. And this has actually taken place, and holds strictly true, in regard to the most important of them.

His discoveries respecting the impregnation of the queen-bee; the consequences of retarded impregnation; the power possessed by the working-bees of converting a worker Larva into a Queen—a fact, though not originally discovered by Huber, yet, until his decisive experiments and illustrations, never entirely known or credited—the origin of wax and its manner of elaboration; the nature of propolis; the mode of constructing the combs and cells, and of ventilating or renovating the vitiated atmosphere of the hives; these and a variety of other particulars of inferior moment, have almost all been repeatedly verified by succeeding observers, and many of them by the writer of this brief Memoir. It is readily admitted that some of his experiments, when repeated, have not been attended with the results which he led us to expect; and some incidents in the proceedings of the Bees as stated, have not been witnessed by succeeding observers. But in some of these, the error may have been in repetition, in others, the result, even under circumstances apparently the same, may not always be uniform, for the instincts of Bees are liable to modification; and in some he doubtless *may* be, and probably *is*, mistaken.

In passing judgment, however, on his reported discoveries, we ought to keep in view that the author of them has thrown

more light upon the subject of *Bee Culture*, than all the other Naturalists taken together, and that therefore, nothing short of the direct evidence of our senses, the most rigid scrutiny, and the most minute correctness of detail in experiment, can justify our denouncing his accuracy, or drawing different conclusions. His experiments were admirably fitted to elicit the truth, and his inferences so strictly logical, as to afford all reasonable security against any very important error.

Huber's *Nouvelles observations sur les Abeilles*," addressed in form of a letter to his friend Bonnet, appeared in 1792, in one volume. In 1814 a second edition was published at Paris, in two volumes, comprehending the result of additional researches on the same subject, edited in part by his son. An English version appeared in 1806, and was very favorably noticed by the Edingburgh Review. A third edition of this translation was published, in Edingburgh, in 1821, embracing not only the original work of 1792, but also the several additions contained in that of 1814, and which had originally made their appearance in the *Bibliotheque Britannique*.

These additional observations were : on the Origin of Wax, on the use of Farina or Pollen, on the Architecture of Bees, and on the precautions adopted by those insects against the ravages of the *Sphinx Atrapos*.

To enlarge on the personal character and domestic circumstances of Huber, falls not strictly within our province, which embraces only, or chiefly, his writings and character as a Naturalist. There are, however, some features in his disposition, and some circumstances in his personal history, dwelt upon at considerable length by De Candole, which appear so well worthy the attention of our readers, that we cannot forego the opportunity of detailing them, though necessarily in an abridged form.

His manners were remarkably mild and amiable, as is frequently found to be the case with those who are afflicted

with blindness, and his conversation animated and interesting. "When any one" says his friend, "spoke to him on subjects which interested his heart, his noble figure became strikingly animated, and the vivacity of his countenance seemed,by a mysterious magic, to animate even his eyes, which had so long been condemned to blindness." It appears that some of his friends would gladly have persuaded him to try the effect of an operation, on *one* of his eyes, which seemed to be affected only by simple cataract; but he declined the proposal, and bore, not only without complaint, but with habitual cheerfulness, his sad deprivation. His marriage with Maria Aimee Lullin, the daughter of a Swiss magistrate, was in a high degree romantic.

The attachment had begun in their early youth, but was opposed by the lady's father, on the ground of Huber's increasing infirmity; for even then, the gradual decay of his organs of vision was become but too manifest. The affection and devotedness of the young lady, however, appeared to strengthen in proportion to the helplessness of their object. She declared to her parents, that although she would have readily submitted to their will, if the man of her choice could have done without her; yet as he now required the constant attendance of a person who loved him, nothing should prevent her from becoming his wife. Accordingly, as soon as she had attained the age which she imagined gave her a right to decide for herself, she refused many brilliant offers, and united her fate with that of Huber. The union was a happy one. Their mutual good conduct soon brought about the pardon of their disobedience. In the society and affection of his generous minded wife, the blind man felt no wants; she was "eyes to the blind,"—his reader—his secretary and observer—sharer in his enthusiasm on the subject of Natural Science, and an able assistant in his experiments. She was spared to him over forty years. "As long as she lived,"

said he in his old age, "I was not sensible of the misfortune of being blind." The last years of his life were soothed by the attentions of his married daughter, Madame de Molin, whose residence was at Lausanne, and to which place he had removed.

It was about this period that he learned the existence, in Mexico, of Bees without stings; and he was, by the kind exertions of a friend, soon after gratified by a present of a hive of that species. To him, whose life had been almost exclusively devoted to the study and admiration of these insects, we may conceive how great a source of enjoyment this present must have afforded. His feelings towards his Bees was not a feeling of fondness in an ordinary degree, it was a *passion*, as it almost invariably becomes with every one who makes them his study.

The days of Huber were now drawing to a close. In the full possession of his mental faculties, he was able to converse with his friends with his accustomed ease and tranquility, and even to correspond by letter with those at a distance, within two days of his death. He died in the arms of his daughter, on the 22d of December, 1831, in the 81st year of his age.

Apiarians owe more to Huber, for the advancement of Apiarian science, than to any other man. Having in many instances verified some of the most important of his observations, I take the greatest pleasure in acknowledging my many obligations to him, and holding him up before the world as the founder of Apiarian science in a great degree. There are few men, either in ancient or modern times, that have had such means, perseverance and patience in carrying on his many costly experiments for a series of years, as the celebrated

APIS MELLIFICA.

INTRODUCTION.

The domestic Honey Bee has excited a lively and almost universal interest, from the earliest ages.

The philosopher, the poet, and historian, have each delighted in the study of an insect whose nature and habits afford such ample scope for inquiry, and contemplation; and even the less intellectual will readily perceive the profit and gain that can be derived from the Honey Bee, with proper care and management.

"Wise in their government," observes the venerable Kirby, "diligent and active in their employments, devoted to their young and to their queen, the Bees read a lecture to mankind that exemplifies their oriental name, Deburah—*she that speaketh.*"

So high did the ancients carry their admiration of this tiny portion of animated nature, that one philosopher, Aristomachus, it is said, made it the sole object of his study for near three score years; another retired to the woods, and devoted to its contemplation the whole of his life. Both the great Bee Masters left behind them, in writing, the results of their many experiments and observations. However small the contribution of knowledge which we have received from these ancient worthies, they must have greatly aided the progress of their favorite science, and are at all events evidences of the zeal with which it was prosecuted in their day.

About three hundred years after the time at which Aristotle wrote, his observations and discoveries on the Honey Bee were embellished and invested with a species of divinity, by the matchless pen of Virgil, in his fourth Book of Georgics, and it excites feelings of regret, that poetry, which for its beauty and elegance is so universally admired, should be the vehicle of opinions that are founded in error.

About the commencement of the Christian era, Columella, who was a very accurate observer, and exhibited considerable genius as a naturalist, made some useful and curious discoveries and remarks upon Bees, in his treaties *De Re Rustica*. But Columella, like Virgil, appears to have acquiesced in, and copied, the errors of his predecessors.

After him, the elder Pliny gave a sanction to the opinions which he found prevalent, and added to them others of his own. To him we are indebted for the transmission to us of all that was actually known, or supposed to be known, of Natural History in his day.

After the compilation of Pliny's vast Compendium, nearly fourteen hundred years rolled away without anything being done for Entomology, or for Natural History in general. The Arabians alone preserved a glimmer of science, during those dark ages that succeeded the fall of the Roman Empire.

On the revival of learning in the fifteenth century, and after the discovery of the Art of Printing, various editions were published of the works on natural History, written by the fathers of that science. Sir Edward Wotton, Conrade Gesner, and others, produced, conjointly, a work on insects, the manuscript of which came into the possession of Doctor Thomas Perry, an eminent Physician and Botanist in the reign of Queen Elizabeth. After devoting fifteen years to the improvement of the work, the Doctor died, and the unfinished manuscripts were purchased at an exorbiant price, by

Mauffet, a cotemporary English physician of singular learning, who with great labor, and at great expense, arranged, and enlarged, and completed the work. When nearly ready for the press, he also died, and the papers, after lying buried in dust and obscurity for several years, at last fell into the hands of Sir Theodore Mayearne, (Baron d' Aubone,) a Court Physician in the time of Charles the First, who gave them to the world in 1634. Swammerdam published his celebrated work, "A General History of Insects," in 1669; a more enlarged edition in two volumes folio, containing the history of Bees, was afterwards published in 1737, under the auspices of Boorhaave, from the manuscript of Swammerdam. Those readers who have patience to wade through these tedious volumes, will be rewarded by the attainment of much curious information.

The French Natural Historian, Reaumur, stands prominent among the students of Entomology, for the unsurpassed enthusiasm and accuracy with which he has investigated some of the most intricate parts. About this period, also, flourished the great, the illustrious Linnæus, whose labors diffused light over every department of natural science, and have just cause to be regarded as one of its brightest ornaments.

Afterwards appeared the works of the celebrated Bonnett, of Geneva, the admiring correspondent of Reaumur, and the patron and friend of Huber. This great Physiologist became addicted to the study of Entomology, before he was seventeen years of age, from reading *Spectacle de La Nature;* and his decisive experiments upon Aphides,* do him the highest credit.

We now come to to the Physiological discoveries of Schirach, Hunter, and Huber, men who have wonderfully ad-

*Aphides, a species of insect that causes the Honey Dew. See chapter upon Honey Dew.

vanced the science of Entomology by a series of experiments most ably conducted, by the most patient investigation, and the most accurate and enlightened observation, and placed it upon the solid foundation of rational induction.

Several other writers, also, both in systematic works and periodical publications, have contributed to, and thrown much light upon, the economy and habits of the Honey Bee. A host of writers upon the nature, habits and culture of the Bee, have written within the last century, and many of them have made valuable discoveries pertaining to the nature of the Bee.

Swammerdam, Maraldi, Reaumur, Bonnett, Schirach, Arthur Dobbs, Esq., Thomas Andrew Knight, Esq., Sir C. S. Mackenzie, George Newport, and the Rev. Dr. Dunbar; and more recently Huber and Thorly, Wildman and Keys, Hunter and Bonner, among ourselves, multiplied a hundred fold the discoveries of Aristotle, Columella and Maraldi.

All the above writers have done much toward the advancement of Apiarian Science.

In the following Treatise it has been my endeavor to combine, as much as possible, the profitable with the instructive and amusing; in seeking which object, I have endeavored to clear the ground before me of the wild flowers of conjecture and hypothesis, with which the human imagination has strewn it, and to substitute in their place the less showy, but more useful products of experiments and rational deduction; the growth of which it should be the object of every laborer in the field of science to promote. I trust, that on a perusal of the experiments and observations detailed in the following pages, my readers will perceive that several of the difficulties and obscurities with which the subject has been beset have been cleared away, and that much has been done recently to illustrate the Physiology, as well as to simplify the man-

agement and culture of the Bee. Our prescribed limits, have restricted us, in a great degree, to mere matter of fact, and prevent us often from illustrating our subject, as we might have done, by reference to the habits and instincts of others of the insect tribes. The same cause has operated as a bar to our indulging, so frequently as our inclinations would have led us; we trust, however, that the facts detailed, will of themselves, lead the mind of the intelligent reader to such reflections, as will secure for him the true merits of Entomology.

THE ANATOMY

OF

THE HONEY BEE.

CHAPTER I.

The Honey Bee, (*Apis Mellifica*) is of the order, *Hymenoptera*, or that species of insects having four membraneous wings. Its anatomic structure presents, even to the superficial observer, striking evidence of design in the All-wise Contriver, and of the admirable adaptation of its parts, to their several uses. The body of the insect is about half an inch in length, of a blackish brown color, which deepens with age, and wholly covered with close-set hairs, which assist greatly in collecting the Farina of flowers. Tearing open the anthers of the plant on which it has alighted, and rolling its little body in the bottom of the corrolla, the insect brushes off the Farina, moistens it with its mouth, and passes it, from one pair of legs to another, until it is safely lodged, in the form of a kidney-shaped pellet, in a spoon-like receptacle, on its hinder legs, (to be noticed hereafter.) These hairs deserve to be particularly remarked, on account of their peculiar formation, being *feather-shaped*, or rather consisting each of a stem, with branches disposed around it, and, therefore, besides more effectually retaining their animal heat, peculiarly adapted for their office of sweeping off the farina. The head, which is of a triangular shape, and much flattened, is furnished with a pair of large eyes, of *composite* construction, and consisting of a vast assemblage of small, hexagonal surfaces, disposed

with exquisite regularity, each constituting, in itself, a perfect eye ; they are thickly studded with hair, which preserves them from dust, &c In addition to these means of vision, the Bee is provided with three small *stemmata*, or coronetted eyes, situated in the very crown of the head, and arranged in the form of a triangle.

These must add considerably to the capacity of vision, in an insect whose most important operations are carried on in deep obscurity. As to the special or peculiar use the *ocelli* may serve, Reaumur and Blumonbach were of opinion, that while the large compound organs are used for viewing distant objects, the simple ones, are employed on objects close at hand. It is not probable, however, that these last, from their peculiar position, are appropriated to upward vision.

The Antennæ present us with another remarkable appendage of the head ; these are two tubes, about the thickness of a hair, springing from between the eyes, and a little below the ocelli ; they are jointed throughout their whole length, each consisting of twelve articulations, and therefore, capable of every variety of flexure. Their extremities are tipped with small round knobs, exquisitely sensible ; and which, from their resemblance to the stemmata, or ocelli, have been supposed, by some, to serve as organs of vision,—by others, as connected with the sense of hearing,—and by others still, as organs of feeling or touch. This last seems the most probable conjecture, as, on approaching any solid object or obstacle, the Bee cautiously brings its antennæ in contact with it, as if exploring its nature. These insects use these organs, also, as a means of recognizing one another; and an interesting instance is stated by Huber, in which they were employed to ascertain the presence of their Queen.

The Mouth of the Bee comprehends the tongue, the *mandible*, or upper jaws, the *maxillæ*, or lower jaws ; the *labrum*, or upper lip ; the *labium*, or lower lip ; with the proboscis connected with

it, and four *palpi*, or feelers. The tongue of the Bee, like that of other animals, is situated within the mouth, and is so small and insignificant in appearance, as not to be easily discernable. In most anatomical descriptions of the Bee, the real tongue, now described, has been erroneously confounded with the *ligula*, or central piece of the proboscis, hereafter to be described. The upper jaw of the Bee, as of all other insects, is divided vertically into two, thus forming in fact, a *pair* of jaws, under the name of *mandibles*. They are more horizontal than the proboscis, and are furnished with teeth, and serve to the little laborers as tools, with which they perform a variety of operations ; as, manipulating the wax—constructing the combs—protecting themselves against their enemies—destroying their Drones, &c. The lower jaws, or *maxilla*, divided vertically, as the others, form, together with the *labium*, or under lip, the complicated apparatus of the proboscis. This organ, beautiful in its construction, and admirably adapted to its end, serving to the insect the purpose of extracting the juices secreted in the nectaries of flowers, consisting principally, of a long, slender piece, named, by entomologists, the *Ligula*, and erroneously, though, considering its position and use, not unnaturally regarded as the tongue. It is, strictly speaking, formed by the prolongation of the lower lip. It is not tubular, as has been supposed, but solid throughout ; consisting of a close succession of cartilaginous rings, above forty in number, each of which is fringed by very minute hairs; having also a tuft at its extremity. It is of a flattish form, and about the thickness of a human hair ; and, from its cartilaginous structure, capable of being easily moved in all directions, rolling from side to side, and lapping or

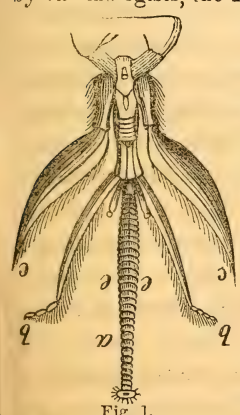


Fig. 1.

licking up, whatever, by the aid of the hairy fringers, adheres to it. It is probably by muscular action, that the fluid which it laps is propelled into the *pharynx*, or canal, situated at its root, and through which it is conveyed to the honey-bag. From the base of this lapping instrument arises the *labial palpi*, or feelers, composed of four articulations of unequal length, the basal one being by much the longest, and whose peculiar office is to ascertain the nature of the food; and both these and the *ligula* are protected from injury by the *maxillæ*, or lower jaws, which envelope them, when in a quiescent state, as between two *demi* sheaths, and thus present the appearance of a single tube. About the middle of the *maxillæ*, are situated the *maxilliary palpi*, of very diminutive size, but having the same office to perform as those situated at the base of the *ligula*. The whole of the apparatus is capable of being doubled up, by means of an articulation, or joint, in the middle. The half next to the lip bends itself inward, and lays itself along the other half, which stretches towards the root, and both are folded together within a very small compass, under the head and neck. The whole machinery rests on a pedicle, not seen in the figure, which admits of its being drawn in, or propelled forward, to a considerable extent.

The celebrated naturalist, Ray, whose knowledge of the minutiæ of insect anatomy was but slender, "was," as Kirby remarks, "at a loss to conceive what could be the use of the complex machinery of the proboscis. We, who perceive its admirable adaptation to the purposes for which it was formed, need not wonder, but we shall be inexcusable if we do not adore."

The Trunk of the Bee, or Thorax, approaches, in figure, to a sphere, and is united to the head by a pedicle or thread-like ligament. It contains the muscles of the wings and legs. The former consists of two pair of unequal size, and are attached to each other by slender hooks, and easily discernable through a microscope; and thereby their motion, and the flight of the insect, are rendered more steady. Behind the wings, on each side

of the trunk, are situated several small orifices, called *stigmati*, or *spiracles*, through which respiration is effected. These orifices are connected with a system of air vessels, pervading every part of the body, and serving the purpose of lungs ; the rushing of air through them, against the wings, while in motion, is supposed, by many eminent authors, to be the cause of the humming sound made by the Bees. To the lower part of the trunk are attached three pairs of legs. The anterior pair, which are the most efficient instruments, serving to the insect the same purpose as the arms and hands to man, are the shortest, and the posterior pair the longest. In each of these limbs are several articulations or joints, of which three are larger than the others, serving to connect the thigh, the leg, or *pellet*, and the foot, or *tarsus ;* the others are situated chiefly in the *tarsus ;* the *tibia*, or pallet, containing on the opposite side the basket or cavity. In each of the hinder limbs, there is an admirable provision made for enabling the Bee to carry to its hive an important part of its stores, and which neither the Queen nor the male possesses, being exempt from that labor, viz : a small triangular cavity, of a spoon-like shape, the exterior of which is smooth and glassy, while its inner surface is lined with strong, close-set hairs. This cavity forms a kind of basket, destined to receive the pollen of flowers, the principal ingredient composing the food of the young. It receives also, the *propolis*, a viscous substance, by which the combs are attached to the top and walls of the hive, and by which any holes are stopped that might admit vermin, rain or cold. The hairs with which the basket is lined, are designed to retain firmly the material with which the thigh is loaded. The three pairs of legs are all furnished, particularly the joints, with thick-set hairs, forming brushes ; some of them round, and some flattened, and which, as we have said before, serve the purpose of sweeping off the farina. There is yet another remarkable peculiarity in this third pair of limbs. The junction of the pallet and tarsus is effected in such a manner as to form, by the

curved shape of the corresponding parts, "a pair of real pincers. A row of shelly teeth, like those of a comb, proceeds from the lower edge of the pallet, corresponding to the bundles of very strong hairs with which the neighboring portion of the brush is provided. When the two edges of the pincers meet, that is, the under edge of the pallet and the upper edge of the brush, the hairs of each are incorporated together," The extremeties of the six feet, or *tarsi*, terminate each in two hooks, with their points opposed to each other, by means of which the Bees fix themselves to the roof of the hive, and to one another when suspended, as they often are, in the form of curtains, inverted cones, festoons, ladders, &c. From the middle of these hooks proceeds a little thin appendage, which, when not in use, lies folded double through its whole breadth ; when in action, it enables the insect to sustain its body in opposition to the force of gravity, and thereby adhere to, and walk freely and securely upon, glass and other slippery substances, with its feet upwards.


Fig. 2.

Figure 2 represents the body portion of the Bee, showing more particularly the abdomen, and the manner of manipulating wax, which accumulates on the abdomen of the Bee, in little fine scales, as shown in the figure. The abdomen is attached to the posterior part of the thorax by a slender ligament, like that which unites the thorax and the head, consisting of six scaly rings of unequal breadth. It contains the honey-bag or first stomach, the small intestines, the venom bag, and the sting. An opening, placed at the root of the proboscis, is the mouth of the *œsophagus*, or gullet, which traverses the trunk and leads to the anterior stomach. This is but a dilation of the gullet, and, in fact, it is what is called the honey-bag. When full, it exhibits the form of a small transparent globe, somewhat less in size than a pea ; it is susceptible of contraction, and so organized as to enable the Bee to disgorge its contents. The second stomach, which is separated from the first, (of which it appears to be merely a continuation,)

only by a very short tube, is cylindrical and very muscular ; it is the receptacle for the food, which is there digested and conveyed into the small intestines, for the nourishment of the body, and for the elaboration of wax, &c. Scales of wax are found ranged in pairs and contained in minute receptacles, under the lower segments of the abdomen. No direct channel of communication between the stomach and these receptacles, or wax pockets, has yet been discovered ; but Huber conjectures that the secreting vessels are contained in the membrane which lines these receptacles, and which is covered with a reticulation of hexagonal meshes, analogous to the inner coat of the second stomach of ruminating quadrupeds. Only eight scales are furnished by each individual Bee; for the first and last ring, constituted differently from the others, afford none. The scales do not rest immediately on the body of the insect ; a slight liquid medium is interposed, which serves to lubricate the junctures of the rings, and facilitate the extraction of the scales of wax, which might, otherwise, adhere too firmly to the sides of the receptacles.

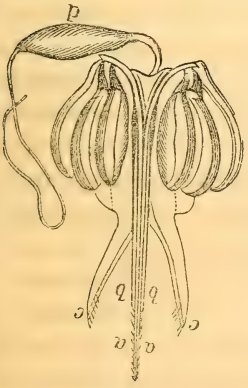


Fig. 3.

The Sting, (Fig. 3) with its appendages, lies close to the last stomach, and, like the proboscis, may seem to the naked eye, a simple instrument, while it is in fact, no less complex in its structure than the former apparatus. Instead of its being a simple, sharp-pointed weapon like a fine needle, it is composed of two branches or darts, applied to each other longitudinally, and lodged in one sheath, (*a. a.*) One of these darts is somewhat longer than the other ; they penetrate alternately, taking hold of the flesh until the sting is completely buried. The sheath is formed by two horny scales, (themselves inclosed within two fleshy sheaths, *c c.*) along the groove of which, when the sting is extruded, flows the poison

from a bag or reservoir, (*d*) in the body of the insect, near the root of the sting. The darts composing this weapon are each furnished with five or six teeth, or barbs, set obliquely on their outer side, which gives the instrument the appearance of an arrow, and by which it is retained in the wound it has made till the poison has been ejected ; and though it is said the insect has the power of raising or depressing them at pleasure, it often happens, when suddenly driven away, that it is unable to extricate itself, without leaving behind the whole apparatus, and even part of its intestines ; death is the inevitable consequence, in less than twenty-four hours after. Though detached from the insect, this formidable weapon still retains, by means of the strong muscles by which it is impelled, the power of forcing itself, to the depth of an eighth of an inch, through the thick skin of a man's hand.

The action of the sting affords us an example of the union of *Chemistry* and *Mechanism* combined ; of Chemistry, in respect to the venom, which, in so small a quantity, can produce such powerful effects ;—of Mechanism, as the sting is not a simple, but a compound instrument. The machinery would have been comparatively useless—*telum imbelle*—had it not been for the chemical process, by which, in the insect's body, *honey* is converted into *poison ;* and on the other hand, the poison would have been ineffectual without an instrument to wound, and a syringe to inject the fluid. Having noticed these particulars in the anatomical structure of the Neuter, or Working Bee, we shall next point out in what respects it differs from the Queen, the Mother Bee, and the Drone, or Male Bee.



Fig. 4.

The QUEEN is frequently styled by the continental Naturalist, the Mother Bee, or Perfect Female, and the only perfect female in the whole colony. First, the Queen has a long tapering body, short wings, much shorter than her body, which is not the case, either with the Drone, (but quite the reverse), or the Working Bee. It is fully

ascertained that her distinguishing qualities have a closer relation to the properties of a parent, than to the province of a sovereign. Her body differs from that of a worker, in being considerably larger, and of a deeper black in the upper parts, while the under surface and the limbs are of a rich tawny color. Her proboscis is more slender; her legs are longer than those of a worker, but without the hairy brushes at the joints; and as she is exempted from the drudgery of collecting farina or propolis, the posterior pair are without the spoon-like cavity found in those of her laboring offspring. When about to become a mother, her body is considerably swollen and elongated, and her wings, consequently, appear disproportionably short. The abdomen of the queen contains the ovarum, consisting of two branches, each of which contains a large assemblage of vessels filled with eggs, and terminating in what is called the oviduct. This duct, when approaching the anus, dilates itself into a larger receptacle, into which the eggs are discharged, and which is considered by naturalists, the sperm reservoir, or depository of fecundating matter; from thence they are extruded by the insect, and deposited in the cell prepared for their reception. The sting possessed by the queen is bent or curved under somewhat, while that of a worker is straight; it is seldom, however, brought into action, only in contact with a rival queen.*



Fig. 5.

The DRONE has been ascertained, by microscopic examination, to be a perfect Male; is considerably more bulky than the Working Bee, and his wings somewhat longer than his body; the eyes are more prominent; the antennæ has thirteen articulations, instead of twelve; the proboscis is shorter; the hind legs have not the baskets for containing farina, and he is unprovided with a sting; the cavity of the abdomen is wholly occu-

*For a more full description of the Queen, see chapter on Queen.

pied with the digestive and reproductive organs. The very loud humming noise he makes when flying, has fixed upon him the appellation of Drone.*

CHAPTER II.

The Senses of Bees.

Much uncertainty has prevailed upon the subject of the senses possessed by this insect; not so much, perhaps, in regard to their *existence*, as to the locality of the organs. Most naturalists admit their possession of five senses, analagous to those of men, though the celebrated Huber seems to have had some doubt as to the existence of the sense of hearing in Bees, at least without some important modifications. Greater diversity of opinion, however, prevails as to the *situation* of those organs by which the impressions of sight, touch, taste, sound, and smell, are produced on their sensations; and many curious experiments by different naturalists, have been made, with a view to ascertain the truth, but which have not always led to the same results. In researches so minute, it is, perhaps, vain to look for perfect accuracy in our conclusions, and we must be satisfied with any thing like a reasonable approximation to the truth.

Sight. In the anatomical structure of the head of the Bee, we observed, that, besides the large reticulated eyes, placed as in other animals, on the sides of the head, this insect possessed three *stemmata*, or coronetted eyes, arranged triangularly on its center, between the antennæ. That these little specks, are, in reality, organs of vision, has been made apparent from accurate

*See chapter on Drones, for a more particular description.

experiments, in which, when the reticulated eyes were blindfolded, the insect was evidently not deprived of sight, though the direction of its flight, being vertical, seems to prove that the *stemmata* were adapted only, or chiefly, to upward vision. This additional organ must, doubtless, add considerably to its power of sight though probably, its aid may be confined principally to the obscure recesses of the hive. As the internal operations of the insect, in the honey season, are carried on during the night, as well as the day, the coronetted eyes may, as Reaumur conjectures, serve the purpose of a microscope. As to the general power of vision in the Bee, its organs appear better adapted to distant objects, than to such as are close at hand. When returning loaded from the fields, it flies with unerring certainty, and distinguishes at once its own domicil, in the midst of a crowded Apiary. Yet every person who has at all made this insect the subject of observation, must have seen it often at a loss, in returning to its hive, to find the entrance, especially if its habitation has been a little moved from its former station ; nay, without moving the hive, if the entrance had been moved around a single inch, from its former position, the bees fly with unerring precision to that same familiar spot on the alighting-board, where the entrance formerly was, and frequently, after many fruitless attempts to find the entrance, it is forced to rise again in the air, with a view, we may suppose, of removing to such a distance from the desired object, as is suited to the focus of its visual organs. We are to conclude, therefore, from these well-known facts, that the eye has a lengthened focus, and that it must depend upon the aid of other organs, in viewing objects which are close at hand.

Feeling or Touch. The organs of this sense are supposed, with reason, to reside in the *antennæ* and *palpi*, or feelers, particularly in the former. Huber concludes that the antennæ supply the want of sight in the interior of the hive, and that it is solely by their means they are enabled to construct their combs

in darkness, pour their honey into the magazines, feed their young, guard their hive, judge of their age and necessities, and recognize their queen. Though it by no means appears clear, that the bees are devoid of sight when employed in their in-door operations; though, on the contrary, there is reason to believe, as already stated, that the *stemmata*, or *ocelli*, serve as orbs of vision,* this naturalist is probably right in ascribing to the antennæ an important share in these operations. That the bees use them as means of communication and recognition, is admitted by Apiarians. When a hive has lost its queen, the event, as may well be supposed, causes a high degree of agitation in the colony; the disturbed workers who have first, by some unknown means, acquired the knowledge of this public calamity, soon quit their immediate circle, and "meeting their companions," says Huber, "the antennæ are reciprocally crossed, and they slightly strike them." The communication made by these means is quickly disseminated, and in a few moments the whole colony is in a state of agitation and distress. Of the antennæ being employed as instruments of recognition, the same naturalist gives a striking instance, which our limits prohibit us from giving in his own words; suffice it to say here, that by means of a wire-grating, wide enough only to admit the circulation of air, inserted in the middle of the hive, he separated the queen from half of her subjects, and ascertained that neither sight, hearing, nor smell, made the near neighborhood of their sovereign known to them; for they proceeded to rear a new queen from the larva of a worker, as if the other were irrevocably lost. But when he substituted a grating large enough to allow the transmission of the antennæ, all went on as usual; for the bees soon ascertained by these organs, the existence of their queen. Another important use which the bees make of this organ of touch, deserves notice:

*I think it very doubtful that Bees have more than one pair of eyes. Why is it not reasonable to suppose that Bees can see in the interior part of the hive, (where it is generally perfect darkness,) as other species of insects and animals see equally as well in the dark?

"Let us follow their operations by moonshine, when they keep watch at the opening of the hive, to prevent the intrusion of moths then on the wing. It is curious to observe how artfully the moth knows how to profit to the disadvantage of the bee, which requires much light for seeing objects, and the precaution taken by the latter in reconnoitering and expelling so dangerous an enemy. Like vigilant sentinels, they patrol around their habitations with their antennæ stretched straight before them, or turning to right or left; wo to the moth if it cannot escape their contact; it tries to glide along between the guards, carefully avoiding their flexible organs, as if aware that its safety depended on its caution."

Taste in Bees. Taste appears, on a slight view, to differ most materially from that sense in man, and because, with all their eager fondness for the rich nectar of flowers, they are frequently detected in lapping the impure fluid from corrupted marshes, it has been hastily concluded that their sense of taste is very defective. Huber thought it the least perfect of the bee-senses, and cites instances of their gathering honey ever from poisonous flowers, and regaling themselves with fetid liquids. Now, with deference to this distinguished observer, we may be permitted, perhaps, to defend our favorites from so injurious an imputation. We have *prima facie* evidence of the delicacy of their taste, in their eager activity in collecting their delicious stores of honey, secreted by the most fragrant flowers; such is their ardor in these operations, that they defy the elements, when the honey-season is at its height, and, laying aside their usual fears of bad weather, boldly encounter wind and rain, to get at their favorite fluid. Huber acknowledges, that "when the lime-tree and black grain blossom, they brave the rain, and depart before sun-rise, and return later than ordinary. But their activity relaxes after the flowers have faded, and when the enamel adorning of the

meadow has fal'en under the scythe, the bees remain in their dwelling, however brilliant the sunshine." Wherefore have they not, in this decline of the flowering season, recourse to the foul marsh and slimy pool, which they are charged with frequenting ? Simply because the purposes for which they did frequent those unwholsome places, have already been answered. The truth is, the bees have recourse in spring, but generally speaking in spring only, to dung-hills, stagnant pools and marshes, for the sake of the salts with which they are impregnated, and which their instinct teaches them is advantageous to their health after their long winter's confinement. If we place before the bees a portion of honey and a portion of liquid drawn from a corrupt pool, their choice will completely vindicate the purity of their tastes, and their power of discrimination in the selection of their food. It is not meant to be denied, however, that the sense or taste of bees is never at fault. This would be going in the face of some well-authenticated instances of honey being injured, and even rendered dangerous, in consequence of the bees feeding on noxious plants. Towards the close of the honey season, when the flowers become scarce, and in those parts of the country where alders abound, and where onions and leeks are extensively raised and allowed to run to seed, the bees, either from taste or necessity, are seen to feed on these plants, which communicate to the honey a very disagreeable flavor. But this is not all ; the fact stated by Xenophon in the Retreat of the Ten Thousand, and confirmed by *Diodorus Siculus*, proves that there are plants in Asia Minor, which give to the honey not only disagreeable, but poisonous qualities. He tells us that the soldiers having eaten a quantity of honey in the environs of Trebizande, were seized with vertigo, vomiting, &c. This effect was attributed to the rose-laurels (*Rhododendron Ponticum.*) Father Lamberti, also, assures us that a shrub of mingrela produces a kind of honey which

causes very deleterious effects. It is quite possible that the poisonous juices extracted from those plants, might be innoxious to the bees themselves, and thus the correctness of their tastes might be so far vindicated. Sir J. E. Smith asserts, that the "nectar of plants is not poisonous to bees;" and an instance is given in the American Philosophical Transactions, of a party of young men, who, induced by the prospects of gain, having moved their hives from Pennsylvania to New Jersey, where there are vast savannahs, finely painted with flowers of the Kalmia Angustifolia, could not use or dispose of their honey on account of its intoxicating quality, yet the "bees increased prodigiously;" an increase only to be explained, says Doctor Benan, in their being well and harmlessly fed. Nor is this defence of the taste of bees successfully controverted by the following occurrence, stated in Nicholson's Journal.* "A large swarm of bees having settled," observes that author, "on a branch of the poison-ash, (*Rhus Vernix, L.*) in the county of Westchester, near New York city, was put into a hive, and removed to a place where it was to remain. Next morning the bees were found dead, swelled to double their natural size, and black, except a few which appeared torpid and feeble, and soon died, after exposure to the air." This was attributed to their being poisoned; not by their having fed upon, but by the *effluvia* of the *Rhus Vernix*, or poison-ash.

HEARING. Considerable difference of opinion has prevailed among naturalists, both as to the existence of this sense, in bees, and the situation of the organ. Aristotle, who flourished before the Christian era, was doubtful whether bees possessed this sense: "*Incertum est an audiant.*" Linnæus and Bonnet believed them to possess this faculty, and Huber seems undecided on the point; while a host of others, among

*Page 287.

whom are ranked Kirby and Spence, maintain its existence, and place the organ in the antennæ. We know that the bees dislike noise, for an apiary situated near a mill or forge, or where there is any very great noise, is seldom prosperous. The different modulations of sound produced by the wings in flying, seem intended as means of communication addressed to organs of hearing; as signals of attack, of recall, of departure, &c. In consequence of a belief in the reality of this sense in bees, the practice has arisen of beating sonorous bodies at the moment of swarming, in order to prevent them from communicating with any other swarm that may perchance be on the point of swarming, and also to present an obstacle to their flying away. We know, also, that many other insects possess this faculty; and, as we observe in the proceedings of bees, the same effects which in other insects, unquestionably proceed from a sense of hearing, we regard these effects as presumptive evidence of the former possessing the same faculty. Huber sets out with initiating a doubt of its existence, in defence of his friend Bonnet, to whom his letters are addressed, and who was an unbeliever in its reality, yet in the end confesses that he is strongly tempted to believe in it, or at least to admit a sense in bees *analagous* to hearing; observing that certain sounds as produced by bees, apparently serve as a signal to their companions, and are followed by regular consequences, and that, therefore, these may be additional means of communication, to those afforded by the antennæ. He mentions, particularly, a sound emitted by the queen, which produces paralyzing effects on the bees in certain circumstances. Describing the attempt of a reigning queen to destroy her rivals while yet in their cells, he tells us, that "the bees on guard pulled, bit her, and drove her away." In these circumstances she emitted the sound alluded to; "standing while doing so, with her thorax

against a comb and her wings crossed on her back, in motion, but without being unfolded or opened. Whatever might be the cause of assuming this attitude, the bees were affected by it; all hung down their heads and remained motionless."* On another occasion, after the queen had put her rival to death, she approached a royal cell, and took this moment to utter the *sound* and assume that posture which strikes the bees "motionless." This discovery of Huber has been brought forward on his authority, by naturalists, as a conclusive evidence of the existence of the auditor's faculty in bees. And so it would be, if Huber was not mistaken in his supposed discovery. A voice of sovereignty, producing such powerful and instantaneous effects on her subjects, is so remarkable a property of her bee-majesty, that it would be desirable to have its existence prov d beyond doubt, by succeeding experiments. With much confidence in the accuracy of this distinguished naturalist's observations, we entertain some hesitation on the subject of this magical sound. We have seen a queen in all the circumstances, and in all the positions observable within a hive; (with one exception, viz: combatting a rival queen,) we have observed her very frequently in the particular situation described by Huber, when he first heard the commanding voice, endeavoring to tear open the cell of a rival queen, and angrily repulsed by the workers; then standing at a little distance on the surface of the combs. with her wings crossed over her back and in motion, though not fully unfolded, and emitting the clear distinct sound heard in a hive for a day or two before the departure of a second swarm; and certainly, we never witnessed any such effects produced on the bees as Huber speaks of. But still, Huber may be in the right, and his general accuracy affords a presumption in his favor; nevertheless, it would

*Huber, 157.

be very satisfactory to have his accuracy on this particular point, confirmed by some other observer. Taking it for granted that the sense of hearing does exist in bees, where are we to look for the locality of the organ? Naturalists are not agreed on this point, but the majority seem to locate it in the antennæ. Kirby and Spence notice the analogy borne by the antennæ to the ears of vertebrated animals, and observe that no other organ has been found that can represent the ear. In that case, this appendage of the head of the bee, must be regarded as a compound organ, exercising the functions of both *hearing* and *touch*. It has already been hinted that some observers have regarded it as the organ of *vision*, and we shall hereafter find that there are those who regard it as the organ of *smell*. In this deficiency of precise knowledge on the subject, we may perhaps rest satisfied with the opinion of Kirby that "the antennæ, by a peculiar structure, may collect notices from the atmosphere, receive pulses or vibrations, and communicate them to the censorium; which communications, though not precisely to be called *hearing*, may answer the same purpose." The same author gives an anecdote of another insect, which goes to prove that the antennæ are indeed the organs of this sense: "A little moth was reposing on my window—I made a quiet, not loud, but distinct noise—the nearest antennæ immediately moved towards it—I repeated the noise at least a dozen times, and it was followed every time by the same motion of that organ, till at length the insect becoming alarmed, became agitated and violent in its motions. In this instance it could not be *touch*, since the antennæ were not applied to a surface, but directed towards the quarter from which the sound came, as if to listen."

Smelling. Of all their senses, that of Smelling in bees, is the most acute. Attracted by the fragrance of the flowers, we see them winging their eager way to a very conside-

rable distance, in a straight, undeviating course, and in the very teeth of a strong wind,* in search of those plants which promise an abundant honey harvest. Very striking proofs of the acuteness of this sense, may be observed within the limits of the Apiary. Early in spring, when the bee-master begins feeding his colonies, he has reason to marvel at the instantaneous notice which this organ gives them, of his approach amongst his hives; though from the chilliness of a spring morning, not a bee is seen stirring out of doors, he has not time to fill his feeding troughs from the vessel in his hand, before he is surrounded by hundreds of the greedy feeders. (*For feeding Bees, see chapter on Feeding.*) It is to their exquisite sense of smell, in all probability, that we must attribute their capability of distinguishing friend from foe, among their own species. If a stranger-bee, by mistake, enter a hive, and this sometimes happens in consequence of some slight alteration in the arrangement of the Apiary, his close resemblance to his fellow-insects, will not secure him from an immediate attack from all quarters; he is detected by a more subtle sense than vision, and instant flight alone can save him. Huber, to whose researches we are so much indebted, in regard to the senses of bees, has made some very conclusive experiments on that of smell; many of them we have repeated with similar results. Like him, our first experiments were to ascertain the acuteness of the sense of smell. He concealed a vessel of honey behind the shutters of an open window, near the Apiary. In our experiment, a small box

*It is said that bees ballast themselves with sand and gravel, when in danger of being blown away by the wind. The notion was first entertained by Aristotle, and repeated by Virgil, to whose poetical imagination such a trait in the habits of his favorite insects would be highly grateful. Pliny has also lent his aid to the currency of this notion; and it is found in dissertations on the natural history of bees, as a surprising instance of bee-instinct, notwithstanding the correctness of Swammerdam and Reaumur, both of whom have shown that the *mason-bee* has been mistaken for the *honey-bee*, the former of whom is often seen hastening through the air, loaded with sand and gravel, the material of its nest.

containing a portion of honey mingled with ale, and covered with a piece of wire-gauze, was placed at a distance of 75 or 80 yards from the Apiary, underneath a bunch of bushes, where it was by no means conspicuous. In a quarter of an hour a bee alighted on the box, and in a few minutes more, while this one was eagerly exploring and striving to gain an entrance, several more joined it. The cover was then raised, and admission given, and after the first visitors had filled themselves and gone off, the feeders increased in the space of an hour, to hundreds. To diversify the trial, Huber procured four small boxes, to the aperature of which, large enough to admit a bee, he fitted shutters or valves made of card paper, which it was necessary should be forced open in order to gain admission. Honey being put into them, they were placed at the distance of two hundred paces from the Apiary. In half an hour bees were seen arriving,—carefully traversing the boxes, they soon discovered the openings, pressed against the valves, and reached the honey. This is a striking instance of the delicacy of smell in these insects, as not only was the honey quite concealed from view, but its odorous effluvia, from being covered and disguised in the experiment, could not be much diffused. We repeated successfully, a similar experiment. In fact, after the first trial, we had no doubt of the issue of the second ; for if once the sense of smell in the bees ascertained the existence of the honey, we had seen enough of their ingenuity in other cases, not to doubt their success in other respects. In endeavoring to ascertain the precise situation of the organ, there is considerable difficulty, and our curiosity cannot be easily gratified without some sacrifice of bee-life. Huber's experiments to ascertain this point, are full of interest. He dipped a pencil in oil of turpentine, a substance very disagreeable to insects, and presented it to the thorax, the stigmata, the abdomen, the antennæ, the eyes, and the proboscis, without the bee's betraying the slightest symp-

tom of uneasy feeling. It was otherwise when he held it to the mouth ; it started, it left the honey by which it had been enticed, and was on the point of taking flight, when the pencil was withdrawn. He next filled the mouth with flour-paste when the insect seemed to have lost the sense of smell altogether. Honey did not attract it, nor did offensive odors, neither did the formidable turpentine annoy it. The organ of smell, therefore, seems to reside in the mouth, or in the parts depending on it To those who may wish to try this experiment, we would recommend that they previously deprive the bee of a portion of his sting, which may be easily done by forcing the insect to extrude it, and then nipping it off about midway with a pair of scissors ; the excision will not vitally injure the insect, and will give confidence to the experimenter in so doing. We cannot conclude this disquisition on the sense of smell in bees, without gratifying our readers by extracting from Dr. Bevan's work, a remarkable instance of its acuteness and delicacy, and which had been communicated to him by the son of the gentleman who is the subject of it It is generally believed that bees have an antipathy to particular individuals, arising, probably, from some peculiar odor about them, which, though not discernable by, or unpleasant to man, may be so to this sensitive insect. "*M. de Hafer, Conseilleur d' Etat du Grand duc de Baden,*" had for years been a proprietor and admirer of bees, and rivaled Wildman, in the power he possessed of approaching them with impunity. He would at any time search for the Queen, take hold of her gently, and place her on his hand. But he was unfortunately attacked with a violent fever, and was for a long time confined by it. On his recovery, he attempted to resume his favorite amusement among the bees, returning to them with all that confidence and pleasure which he had felt on former occasions ; when, to his great surprise and disappointment, he discovered that he was no longer in possession

of their favor ; and that instead of being received by them as an old friend, he was treated as a trespasser; nor was he *ever* able after this period, to perform an operation with them, or to approach within their precincts, without exciting their anger. Here, then, it was pretty evident that some change had taken place in the person ; the secretions had changed in consequence of the fever, which, though not noticeable by his friends, was offensive to the olfactory nerves of the bees."

Functions of the Inmates of a Hive.—A hive consists of a Queen, or mother-bee, the Workers, or Neuters, as the ancients used to call them, varying in numbers from 5,000 to 50,000, and the Drones, or male bees, from 500 to 5000, according to circumstances. Particulars will be given in another chapter.

Functions of the Queen. The Queen is the parent of the hive, and her sole province and occupation consists in laying the eggs, from which originate those prodigious multitudes that people a hive, and emigrate from it in the course of a summer. In the height of the season, many times, her great fertility is truly astonishing, as she is capable of laying two and three thousand eggs per day, when everything is favorable. The great laying season usually commences with the warm weather, and lasts about three months ; the month of May is usually the first laying month, but in these northern latitudes, the forwardness or backwardness of spring, has much to do with early breeding. If the colony is a prosperous one, and they have a fertile Queen, and well-protected hive, they will breed more or less the year round; in warm climates, bees increase rapidly every month in the year. A Queen usually commences laying worker-eggs about the fifth or sixth day of her age ; though many times they do not commence until they are ten or fifteen days old. It is during the laying of worker-eggs, that the bees are led by their instinct to lay the foundation of royal cells, in which, if the population be abun-

dant, the Queen deposits eggs at intervals of one or two days between each. In the operation of laying, which we have many times witnessed, the Queen puts her head into a cell, and remains in that position a second or two, as if to ascertain whether it is in a fit state to receive the deposit. She then withdraws her head, curves her body downwards, inserts her abdomen into the cell, and turns half round on herself; having kept this position a few moments, she withdraws her body, having in the meantime deposited an egg. The egg itself, which is attached to the bottom of the cell by a glutinous matter, with which it is covered, is of a slender oval shape, slightly curved, rather more pointed in the lower end than in the other. She passes on from cell to cell, furnishing each with the germ of a future inhabitant; and during these proceedings, she receives the most marked and affectionate attentions from the workers. She is seen continually surrounded by a circle of them, who caress her fondly with their antennæ, and occasionally supply her with food from their proboscis. This appearance has given rise to the notion commonly entertained, and asserted even by some naturalists, that the Queen is followed in her progress through the hive, by a number of her subjects, formed in a circle round her, and these of course, have been regarded as the Queen's *body guard*. The truth is, however, that her bee-majesty has no attendants, strictly speaking; none who follow in her train; but wherever she moves, the workers whom she encounters in her progress, instantly and hurriedly clear the way before her, and all turning their heads towards their approaching sovereign, lavish their caresses upon her, with much apparent affection, and touch her softly with their antennæ; and these are circumstances which may be observed every hour in the day, in a perfectly constructed glass hive. The moment she has left the circle, the bees who had surrounded her instantly resume their labors, and she passes on, and receives of ev-

ery group in her way, the homage due to a Mother and a Queen. "On one occasion we gave her subjects an opportunity of testifying their courage in her defence, as well as their affection and zeal. Observing her laying eggs in the comb next to the glass of the hive, we gently, but quickly opened the pane, and endeavored to seize her. But as soon as the removal of the glass made room, (while shut it was almost in contact with her back,) and before we could accomplish our purpose, they threw their bodies upon her, to the number of at least a hundred, and formed a cover over her of such magnitude, that she could not be less than two inches distant from any part of the surface. We dispersed the mass with our finger, and got hold of her precious person, and kept looking at her for some minutes, before we restored the captive to her alarmed defenders. It is remarkable that this violence was not resented by them; though they covered our hands in scores, while we kept hold of their mistress, not one individual used its sting. The all-engrossing object was the Queen. They may be handled, and roughly too, with like impunity when they are swarming. Intent ther, only on securing a habitation for themselves and their sovereign, they seem incapable of any other idea at the same time, if we may use such an expression, and their natural irritability is not awakened to exertion." There is a fact connected with the instinct of the Queen, in laying her eggs, which deserves particular notice, and which we have not seen stated by any other author on the subject of bees.* When she has layed a cluster of eggs to the number of forty or fifty, more or less, according to circumstances, in one side of the comb instead of laying in all the empty cells in the same quarter, she removes to the other side, and lays in the cells which are directly opposite to those which she has just supplied with eggs,

*From the Edingburgh Philosophical Journal.

and, generally speaking, this mode of proceeding is in accordance with that wise arrangement which runs through all the operations of the bees, and is another effect of that remarkable instinct by which they are guided. For as they cluster closely in those parts of the comb which are filled with brood, in order to concentrate the heat that is necessary for their being hatched, the heat will of course penetrate to the other side, and some portion of the heat would be lost, if the cells on that side were either empty or filled with honey or bee-bread. But when both sides are filled with brood, and covered with bees, the heat is confined to the spot where it is necessary, and it is turned to full account in bringing the young bees to maturity.

The mutual aversion of Queens to each other, is a striking feature in the history of this insect; and though not strictly in place, one extraordinary effect of it may be mentioned here. Their mutual enmity may truly be said to be an in-born disposition with them; for no sooner has the first of its race, in a hive about to throw off a second swarm, escaped from her own cradle, than she hurries away in search of those of her rivals, and, as will be hereafter described, exerts herself with the most impetuous eagerness to destroy them. When two Queens happen to emerge from their cell at the same time, a pitched battle usually takes place, which ends in the death of one of the combatants, and sometimes both.

Functions of the Working Bee. The Workers constitute the great mass of the population, and on them devolves the whole labor of the hive. Theirs is the office of searching for and collecting the precious sweet, which not only furnishes their own daily food, as well as that of the young in part, and a surplus of which is laid up for winter stores, but also, the material with which they rear their beautiful combs-

In the little basket-shaped cavity in their hind legs, they bring home the dust of farainceous flowers, or *pollen*, kneaded by the help of the morning dew into tiny balls, which form an important ingredient in the nourishment of the brood; and also the propolis, or adhesive gum extracted from willows, balm-gileads, pine and spruce, and the different kinds of balsamic trees, with which they attach their combs to the hive, and also to fill up the cracks and crevices in the hive, to protect them against the inclemency of the weather. Exploring a glass hive in a soft spring morning, following with his eye a bee loaded with farina, the observer will perceive the little active forager, on her arrival in the interior, hurrying over the surface of the comb in search of a proper cell to deposit her burden; and having found one, fastening herself by the two fore-feet on its superior border, then bending her body a little forward, so that her hinder feet may catch hold of the opposite edges of the cell. In this position she is next seen thrusting back her second pair of feet, one on each side, and sweeping with them from top to bottom, along the two hinder legs, where the farina balls are deposited, and by this means detaching them from the hairy linings of the cavities, and depositing them in the cells. To the Workers, also, are committed the various offices of guarding the entrance of the hive by night and day during the honey season, —of repulsing marauders,—of keeping their abode free from all offensive matter, by renewing the air within by an ingenious mode of ventilation,—of replacing a lost Queen, and of destroying the Drones at the decline of the honey-season.

Receiving from nature these weighty charges, they labor assiduously to fulfill them; and, while each member of the community acts by the impulse of its individual instinct, it works less for private than the general good. These labors seem unceasing, yet do the wary laborers sometimes snatch

an interval of repose. During the busy season, we have seen hundreds of the workers retiring into the cells, and exhibiting all the marks of profound sleep. This fact is very easily observable, especially in those cells which are constructed, as sometimes happens, against the glass, and where that substance forms one side of the cell. There they are, the fatigued laborers, stretched at full length, with their heads at the bottom, and every limb apparently in a relaxed state, while the little body is seen heaving gently from the process of respiration.

It does not appear, however, that these naturalists were acquainted with the different functions, if the difference really does exist, of the two classes. The office of the first class, according to Huber, is not only to collect honey, which both kinds do, but also to elaborate the wax and construct the combs. The particular function of the others, is to take care of the young. They may be distinguished in entering the hive, by carefully examining their shape ; the wax-workers having their bodies somewhat cylindrical, while those of the nurses retain their original figure. The anatomical structure of the two is said to be different, and the capacity of the stomach not the same ; so that the one species is incapable of fulfilling all the functions of the other. Huber has also directed our attention to a class of workers, which he calls black bees, and which he first observed in 1809, and on several occasions from that time till 1813. In every thing they bear a perfect resemblance to their fellow workers, except in color, which in them is a deep black ; he describes them as persecuted by other workers, and finally expelled from the hive or destroyed. It is not impossible, as Kirby and Spence conjecture, that they are merely *aged bees*, and that their deeper color arises from the hair or down with which the young are covered, being worn off their bodies.

I am aware much credit is due to Huber and his many valuable discoveries in Apiarian science, and also to Kirby and Spence. But as regards those black bees that Huber speaks of, I think they are the same kind of bees as the other workers. The color does not argue that they are a different species of bees, for we find that many insects and animals of larger size, are of various colors, when in fact, they are of the same kind and species. I think that Huber is in an error when he asserts that there are two or more kinds of working bees, and that their functions are different. I believe on good authority, that all the working bees, in organization, are precisely the same, except those that may, perchance, partake of a portion of the royal jelly, when reared near the Queen cell ; such, no doubt, have been known to lay eggs that would hatch Drones. As regards a portion of the workers being nurses, and another portion of them to elaborate wax only, Huber may be right in his conjectures; but it is involved in much doubt. I think that the working bees are capable of doing any and every part of the labors of the hive, and that they do it in turn, as circumstances dictate. Why is it not as reasonable to suppose that the working-bee is as capable of doing any part of the work of the hive, as for a farmer to possess skill enough to perform any part of the labors of the farm?

In describing the functions of the working-bee, it would be improper to pass over unnoticed, the fact that it sometimes exercises the functions of a mother. (Mother of Drones only.) To account for this apparent anomaly, we must remember it has been ascertained, by minutely accurate obser-

Huber thinks he has ascertained that there are two kinds of Workers in a hive, one of which he calls *wax-workers*, and the other *nurses*. The difference between these bees had probably been observed by Pliny and Aristotle. Aristotle speaks of "*optimum genus apum, quæ breves, variæ, et in rotunditatem, compactibus ; secundæ quæ longæ et vespis similes.*" Pliny uses similar language.

vations, and dissections, that all the workers are *females*, though of imperfect organization ; a fact confirmed by the very circumstances we are now discussing. We must also keep in mind, that the larva of a Queen is nourished with food of a different kind from that of common bees, and this difference, in conjunction with a more roomy cell, has, in the opinion of naturalists, the effect of expanding the ovarum, and qualifying her to become a mother ; it is evident, therefore, that if the larva of the common bee were fed with the royal jelly, the imperfection in her bodily organs would, as far at least as depended on the nature of the food, be removed, and she would become capable of laying eggs. Now this does, occasionally, take place ; some of the royal food is dropped into the cells adjoining that of the Queen, and the bees therein reared acquire the power of laying eggs. This fact was discovered by the naturalist Rian, and has been confirmed by Huber. There is, however, a very material, and hitherto unaccounted for difference, between these fertile workers and perfect Queens. The former, or fertile workers, lay the eggs of males only. We would certainly have expected, *a priori*, that a difference between them should exist ; because the workers have fed on royal jelly only for a short time, and because their birth-place is so much smaller. This, I think, is conclusive evidence why the fertile workers can lay nothing but Drone eggs; being reared in so small a cell, it would not give her ovaries a chance to expand, while, if this was the case, she would be a perfect Queen in every sense of the term. The fact of her ovaries not being fully developed, is the very reason why she never leaves the hive soon after hatching, to meet the Drones, as the Queens usually do.

These fertile workers are seldom found in any hive except those that have lost their natural Queen. The natural term of the worker's existence, does not extend, we think, beyond

six or eight months. It is the opinion of Dr. Bevan, that all the bees brought into existence by the Queen's great l·ying in spring, die before winter. I'ut many never reach that period ; showers of rain, violent blasts of wind, and sudden changes of atmosphere, destroy them by hundreds. In the clear cold mornings and evenings of autumn, their eagerness for foraging entices them abroad ear'y and late, and when they alight on a flower or shrub, many of them become chilled and quickly perish. And should they escape the blighting atmosphere at the close of autumn, a bright sunshine in a winter day, when the ground perhaps is covered with snow, brings them abroad in multitudes, and one tenth part of them never return. (See chapter on *hives* that are a sure preventive against the *loss of bees* in winter, either in flying out, or dying in the hive.) From these causes, independent of the numbers which fall a prey to their many enemies, a swarm which in July amounted to thirty or forty thousand, will, by the following February or March, have dwindled to a mere handful. It is otherwise with the Queen ; going seldom abroad, she is little exposed to accidents. Her natural life is prolonged to a period of three or four years, and there are instances on record, where they have attained to the age of five and six years. A more particular description will be given in the chapter on Queens.

Functions of the Male, or Drone. The sole object of the Male, or at least the primary one, is to pair with the Queen ; he is the Father of the hive, or the "*Gentleman Bee*," as some of the ancients used to call them. Indolent and luxurious, he takes no part in the internal operations of the domicil, and never leaves it with a view of sharing in the labors of the field. When he does fly abroad, it is only in the finest weather, and during the warmest part of the day, at which time the young Queens are instinctively led to go out in search

of the male. He is easily distinguished from the workers by his large size, his heavy motion in flight, and by his loud humming sound. We have said that the primary functions of the Drone, are to perpetuate the race of bees by pairing with the Queen, but some naturalists have assigned them a secondary office, namely, that of contributing, by their numbers, to the heat of the hive, and thus aiding in bringing the brood to maturity. Feburier informs us they are called *hatchers*, in many parts of the eastern continent. There are occasionally found Drones of a small size in hives where the impregnation of the Queen has been retarded. Under these circumstances, she indiscriminately lays in any of the cells, just as it happens; sometimes in Drone cells, and sometimes in worker cells. But in every instance where a Queen is not impregnated, her progeny will be all Drones, and all those hatching in worker cells will be much dwarfed in size, (and there is much doubt in the minds of many observers, that they are perfect males,) owing to the smallness of their birth-place. The life of this *vir gregis* is very short, as the favored Drone perishes in a few hours after his union with the Queen. (For a more particular description, see chapter on Drones.) As early as the first of August, the bees, as if wishing to apply the "preventive check" to superabundant idle population, begin to manifest deadly intentions towards them; and the unfortunate victims, as if to derive consolation from each other's society, or perhaps driven together by their irascible superiors, may be seen about that period, clustering closely together in some corner of the combs, where they remain without motion, and without once venturing to approach the provision cells. Thus weakened by hunger and captivity, and disqualified for resistance from the want of a sting, they fall an easy prey to their merciless assailants, and a scene of carnage takes place which is difficult to describe. The unhappy

wretches are driven to the bottom of the hive, pursued with such fury that in spite of their strength, which is greatly superior to that of their persecutors, and which enables them to drag two or three of their assailants along the board, and even to fly off with them, they are unable to avoid the mortal thrust of their formidable stings, and expire instantaneously from the effects of the poison. But death overtakes them in various forms; for their enemies sometimes seize them by the wings, and with their strong mandibles gnaw them at the roots and prevent their flying. They may then be seen in numbers crawling on the ground, where they perish with cold, or are trampled under foot, and devoured by birds and frogs; such as escape for a while, may be seen flying from destruction, lighting on the shrubs and flowers to enjoy a moment's respite from their terrors, or buzzing about our windows, or wandering from hive to hive, into which they no sooner enter than certain death awaits them. Nay, so bitter is the fury of their tormentors, that not satisfied with destroying these unhappy beings themselves, they tear from the cells such of the doomed race as are yet in embryo, the larvæ or nymph, and destroy them without mercy, which but a few days before they nourished with so much care and affection. There are cases, however, where the massacre and destruction of the Drones does not take place. "In hives that have lost their Queen," says Huber, "the males are spared, and, while a savage massacre rages in other hives, they here find an asylum. They are tolerated and fed, and many of them may be seen in January. The natural life of the Drone, when not killed by violence, has not as yet been fully established, but probably they would live to be nearly one year old when everything was favorable.

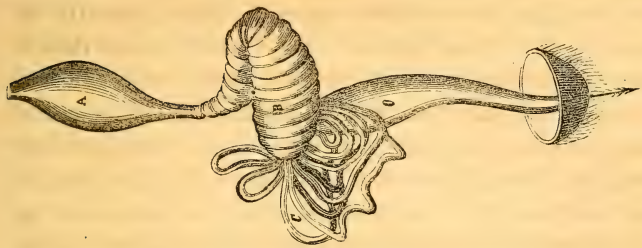


Figure 6.

Anatomical view of the interior part of the Working Bee, showing the honey bag, or first stomach A, also the regular stomach B, the small intestines C, and the rectum O ; also, showing the extreme point of the body, sting, &c. A more particular description of this plate will be given in another chapter, as this cut was overlooked and not inserted in the chapter on the Anatomy of the Bee, as it should have been ; I trust however, that the reader will appreciate it as well as though it had been inserted in its appropriate place.

CHAHPER III.

Impregnation of the Queen Bee.

In looking into a hive in spring or summer, the Queen may be seen laying eggs in the cells ; in the smaller cells those of workers, and in the larger ones, Males or Drones. These eggs if examined on the fourth day of their being deposited, will be found hatched, and a small worm produced, which is floating in a whitish liquid, ascertained to be food introduced

for the nourishment of the infant brood; and in due time a perfect bee emerges from the cell. The Queen lays the egg, and the insect evolves from it; but how is the egg fecundated or rendered fertile? Has the Queen had personal union with the male? No one can speak positively to such a fact. By what other means, then, is this effect produced? The impregnation of the Queen bee, is a branch of Natural History which has given rise to more discussion than almost any other fact connected with the nature of the insect. And, indeed, the difficulty, we might almost say *impossibility*, of obtaining anything like occular evidence on the subject, will readily account for the diversity of opinions that has hitherto prevailed. And we should hope that this difficulty alone, and not any preconceived theory, or unreasonable prejudice, is the cause of that determined pertinacity with which the discoveries and conclusions of Huber, on this subject, are still in some instances rejected. That justly celebrated naturalist instituted a course of experiments on the subject of the Queen's impregnation, the result of which leads to the conclusion that it takes place high in the open air.

"I shall relate in detail," says the celebrated Huber, "what was done by my Secretary and myself, on the 29th of June, 1788. Aware that in summer the males usually leave the hive in the warmest part of the day, it was natural for me to conclude that if the Queens were obliged to go out for fecundation, instinct would naturally induce them to leave the hive at about the same hour of the male bee. At eleven o'clock in the forenoon, we placed ourselves opposite to a hive containing an unimpregnated Queen five days old. The sun had shone from its rising; the air was very warm, and the males had begun to leave the hives in large numbers. We then enlarged the entrance of the one selected for observation, and paid particular attention to the bees entering and departing.

The males appeared and immediately took flight. Soon afterwards the young Queen came to the entrance; at first she did not fly, but during a little time traversed the board, brushing her belly with her hind legs; neither males nor workers seemed to take any notice of her, and at last she took flight. When several feet from the hive she returned and approached it, as if to examine the place of her departure, perhaps judging this precaution necessary to recognize it; she then flew away. We immediately contracted the entrance, that she might not returned unobserved, and placed ourselves in the centre of the circles which she made on the start of her flight, the more easily to follow her and witness all her motions. But she did not remain long in a situation favorable for our observations, and rapidly rose out of sight. We resumed our places before the hive, and in seven minutes the young Queen returned to the hive which she had left for the first time in her life. Having found no external evidence of fecundation, we allowed her to enter. In a quarter of an hour she reappeared, and brushing herself as before, took flight, then returning to examine the hive, she arose so high that we soon lost sight of her. This second absence was much longer than the first, occupying twenty-seven minutes. We now found her in a state quite different from that in which she was after her former excursion; the organs distended by a substance thick and hard, very much resembling that of the male, the *Spermatora*. But more evidence than mere resemblance being requisite to establish that the female had returned with the prolific matter of the males, we allowed this Queen to enter the hive and confined her there. In two days we found her belly swollen, and she had already layed over a hundred eggs in worker cells. To confirm our discoveries, we made several other experiments, and with the same success. On another experiment in July of the same year, the weather being very fine, a large number of males left the

hives, and we set at liberty a young virgin Queen, eleven days old; (whose hive had always been deprived of Drones, or which had never brooded any.) having quickly left the hive she returned to examine it, and then rose out of sight; she came back in a few minutes with evident marks of fecundation, the same as the first one.*

It appears from our most scientific Apiarians, that the Queen bee never has, nor can be impregnated in the hive, but always in the open air. It is better that the Drones for the Queen's impregnation, should be from another colony, and still better from a neighboring Apiary; hence the uselessness of rearing Drones in every colony of bees, or even in every Apiary, especially in a bee country, for the more Drones there are, the less honey there will be. See chapter on Drones for a more definite description and history.

RETARDED IMPREGNATION. There is a fact connected with this part of the natural history of the mother bee, which involves great difficulties. The fact itself was discovered by Huber, but its cause he was unable to develope, and no succeeding naturalist has been able to free it from the obscurity in which he has left it We mean the effect of retarded impregnation. These effects are such as we could hardly credit, were not the fact confirmed by numerous experiments. If impregnation be delayed longer than twenty days from the Queen's birth, the consequence is, none but Drone eggs are layed, even during the whole life.

I supppose the naturalist means to assert that the egg the Queen lays will hatch a drone, whether it is deposited in a worker cell or drone cell. It appears from the many experi-

*It will afterwards appear, that what we took for the generative matter, was the male organs left in the body of the Queen; it is generally supposed by entomologists that the Drone never has but one union with the Queen in his whole life. If Huber's theory is correct, the reason why they do not is obvious.

ments of some of our ancient naturalists, that the Queen is capable of laying eggs, even though a virgin Queen that had never paired with the Drone; but in every instance they would hatch drones, whether they were deposited in drone cells or not. It is nothing very remarkable that a virgin Queen is capable of laying eggs, but it is very strange that they should produce any kind of Bees.

This phenomenon has baffled every attempt to explain its cause. "There are mysteries," observes Feburier, "in the rational as well as the irrational creation, which will, probably, forever remain mysteries to man." In the natural state of things, that is, when fecundation has not been postponed, the Queen lays worker eggs in forty-six hours after her union with the male, and continues to do so for the subsequent eleven months, providing there spare are cells in the hive for their reception.

The conversion of a Worker Larva into a Queen. Bees, when deprived of their Queen, are endowed by nature with the power of remedying this calamity, by converting the larva of a worker into a royal one, and by means of a cell of a larger size, and of a peculiar kind of nourishment, producing a female that shall be to all intents and purposes, a Queen, or Mother bee, capable of perpetuating her kind. The discovery of this singular fact, is generally attributed to Schirach, and, probably, with justice; for although the practice of making artificial swarms, which can only be effected by causing the production of artificial Queens, is said to have prevailed amongst the modern Greeks and Italians, from a very early period, it does not follow, nor does it appear from any authentic documents, that they were aware of the reason why. The manner in which Schirach made the discovery, is interesting. Having used a great quantity of smoke in some of his operations, the bees were so annoyed by it that numbers left the hive, and amongst them the Queen. Knowing the consequence of her loss, he sought for her diligently, but in vain. Next morning he observed a cluster of bees about

the size of an apple, on the prop of the hive whose Queen had fled ; here he discovered a Queen, and having carried her to the entrance of the hive which had lost its Queen, she was immediately surrounded by the bees, and treated in such a manner, as plainly announced that she was their Queen. "What was my astonishment," he proceeds, "when wishing to introduce her amongst the combs, I saw that the bees remaining had already planned, and almost finished, three royal cells. Struck with the sagacity and activity of these creatures, to save themselves from impending ruin and destruction, I was filled with admiration, and adored the infinite goodness of God, in the care taken to perpetuate His works. Having carried away two of the cells, to ascertain whether the bees would continue their operations, I beheld next morning, with the utmost surprise, that they had removed all the food from around the third worm left behind, on purpose to prevent its conversion to a Queen." The fact of this power possessed by the bees, is so extraordinary, that its reality was at first called in question by several eminent naturalists, and, among others, the justly celebrated Bonnet. This naturalist was at last, however, convinced of its reality by experiments instituted by himself, and, satisfied that all the working bees are females of imperfect organization, expressed his opinion that the evolution of the germ is effected by the action of the prolific matter as a stimulant, and as a substantial nutriment suitable for that purpose ; and he supposes that a certain quality of food, administered more copiously than in ordinary cases, may unfold those organs in the larva of the bees, that never would have appeared without it. He conceived also, that a habitation like a Queen-cell, considerably more spacious and differently placed, is absolutely necessary to the complete development of organs which the new nutriment may cause to grow in all directions. It furnishes a surprising evidence of the slow degrees by which scientific facts make their way, if not essential to general utility, when we consider that to this day, the knowledge of this singu-

larity in the natural history of this insect, is confined almost exclusively to Apiarians, and even neglected by some of them. It has, however, been confirmed by so many experiments, instituted by many different individuals, that no unprejudiced mind can withhold its assent to its truth. Extraordinary, however, as this fact is, it is not more so than many others, which have not attracted our particular notice, merely because they are familiar to us.

"If we preserve the seed of a plant," says Feburier, "for a series of years, and supply it with different nourishment and soil, and bestow upon it different treatment from that which was destined for it by nature, we destroy its powers of fecundity; the flower no longer possesses pistils or stamina, petals replace them, and announce the sterility of the plant;" something analogous to this holds true, it is said, in the case of one of our domestic quadrupeds. We find the twin calf, stinted as it has been for room, in the ovarium of its mother, and the recipient of but half the nourishment which would otherwise have fallen to its share, become in after years a barren cow. In case of the bee the egg of the worker, placed in the royal cell, only produces an insect which has its powers more fully developed, in proportion to the ampler space which it occupies, but it acquires no new powers. The germ existed originally in the common bee, as well as in the mother bee, but the confined limits of its cell, and the want of the peculiar kind of food provided for the royal race, prevented its development."

The proceedings of the bees in order to supply the loss of the Queen, are extremely interesting. In about twenty-four hours they are aware of the misfortune, that has befallen them, and without loss of time, they set about repairing the disaster. Much depends upon the state of the weather, the size of the colony, whether it is in the midst of the honey season or not, and whether it is near the time of their swarming; if the latter, they will find it out in the course of five or ten minutes, and in fact, much sooner, if the hive

should receive a bit of a rap ; in fact, many times the loss of the Queen will be known to the bees almost instantly ; then again, at other times, when the weather is cool, they may not realize her loss for several days.

They fix upon a worm not more than three or four days old, demolish the three contiguous cells, and raise around it a regular cylindrical enclosure. At the end of three days the workers change the direction of the cell, which has been hitherto horizontal, into a perpendicular position, working downwards until it assumes something the appearance of an inverted cone, about an inch long. In due time it is sealed over, and the larva undergoes its metamorphosis into a royal nymph.

Huber gives a detail of some interesting experiments on this head, the substance only of which we can present to our readers. He deprived a hive of its Queen, and put into it some pieces of comb containing worker eggs. The same day several cells were enlarged by the bees and converted into royal cells, and the larvæ supplied with a profusion of jelly. He then removed these worms from the royal cells, and substituted for them as many common worms from worker cells. The bees did not seem aware of the change ; they watched over them as intently as over those chosen by themselves. They continued enlarging the cells and closed them at the usual time. At the proper time two Queens were hatched, almost at the same moment, of the largest size, and well formed in every particular. Nothing could be more conclusive than this experiment. It demonstrated that bees have the power to convert the worm of the worker into Queens, since they succeeded in procuring them by operating on worms not chosen by themselves, but selected for them. In addition to this conclusive experiment, we shall take the liberty of detailing two of our own, on the same subject, which were made several years ago, and which we have repeated several times since, with the same success. We give these ex-

periments, not from any idea that those experiments of Huber require confirmation, or that ours are of importance enough to supply any such supposed deficiency, but on the obvious principle, that the more numerous the experiments, and the greater the diversity of experimenters, the more irrefragibly is the alleged fact established, if the result be uniformly the same. "In June, 1822," says an eminent observer, "we instituted an experiment with a view of witnessing a combat between two Queens," and the result as to that object will be hereafter noticed. It was only accidentally that we derived from it a confirmation of the fact in question, and we shall now state the particulars.

We took a hive well peopled, but not possessing, as far as we could discover, any very young brood; we introduced a stranger Queen, with the expectation that the two rival potentates, each of whom, like the Jealous Turk, can bear no rival near her throne, would decide by single combat, which of them should retain the honors and privileges of royalty. We contemplated the possibility of both falling in the conflict at the same moment, an instance of such a calamity having come to our knowledge; therefore with a view of remedying such an evil, if it should occur, and thus of preventing the total destruction of the hive, we took a piece of comb from another hive containing worker eggs, and worms of the proper age, according to the directions of Huber, and fixed it in the experimental hive, so that the bees might rear for themselves a new Queen, should the combat terminate in the death of both. To our astonishment, for at this time both Queens were alive, we saw the bees next morning, busily occupied in building a royal cell in the new piece of comb. They had demolished two or three cells adjoining the one they had pitched on for the royal cradle, and were now eagerly laboring at its enlargement; giving it a circular instead of a hexagonal form and bestowing unceasing attention on the larva it contained. During the day the royal cell made consid-

erable progress, and in the afternoon of the day following, it extended about half an inch vertically, and the next day it advanced rapidly; the worm had attained to a great size, and the bees were unwearied in feeding it. On the fifth day the cell was sealed, and on the fourteenth a young Queen was hatched, but her enjoyment of life and liberty was very short. She was instantly surrounded by a mass of bees, who hemmed her in so closely, that but a very small part of her body was visible. She made many painful and unavailing struggles to escape and emitted every minute a plaintive sound. All the while the reigning Queen (for the stranger had by this time been dispatched, though not in our sight,) occupied herself in laying eggs, often within an inch or two of the prisoner, and going about her avocations with as much unconcern as if she knew that her subjects would, of themselves, soon and effectually rid her of her puny rival. In two hours from her birth, accordingly, the body of the young queen dropped lifeless from the dense mass of bees of her inexorable guard.

Of the other experiment which we are now to detail, the sole object was to prove the existence of the power inherent in bees, of rearing an artificial Queen, when deprived by any accident of their original Mother. This, indeed, had been proved by the experiments above detailed, but only accidentally, and we were anxious by an experiment instituted especially for that object, and conducted with minute and scrupulous accuracy, to put the matter out of all doubt, in our own minds at least.

In July our experimental hive was full of bees, brood and honey; the Queen was very fertile, and laying at the rate of more than 500 eggs per day; we opened the hive and carried her off. For about eighteen hours the bees continued their labors as earnestly and contentedly as if the Queen were still with them. At the end of that time they became aware of their loss, and all was instantly tumult and agitation; the bees hurried backwards and forwards over the combs with a loud noise, rush-

ed in crowds to the door and out of the hive, as if going to swarm, and, in short, exhibited all the symptoms of bereavement and despair. Next morning they had laid the foundation of five royal cells, having demolished the three cells contiguous to each of those that were to become royal cells, and by the afternoon there were visible the rudiments of four more royal cells, in all quarters of the combs, where before were nothing but eggs and common larvæ of one or two days old. Two of these royal cells advanced more rapidly than the rest, probably from the larvæ being of an age the fittest for the purpose ; four came on more slowly, and three made no progress after the third day. On the seventh day the two first were sealed, and two more nearly so, but neither of these nor any of the rest advanced farther, as if the bees were satisfied that they had succeeded in getting at least *one Queen*, and judged it unnecessary to carry forward the others to maturity. On the morning of the fourteenth day from the removal of the old Queen, a young one emerged from her cell, strong and active, and exactly resembling those produced in the natural way. While watching her motions, I saw her hasten to the other royal cell, and attempt to tear it open, doubtless with the intention of killing its inmate ; but the workers pulled her violently back, and continued to do so as often as she renewed the assault. At every repulse she assumed a sulky attitude, and emitted the shrill monotonous *p ep*, *peep*, *peep*, so well known to bee masters, while the unhatched Queen emitted the same kind of sound, but in a hoarser tone, the consequence of her confined situation ; and this, by the way, accounts for the two different sounds which are generally heard from a hive on the eve of throwing off a second swarm. The shrill sound proceeds from the reigning queen, and seems to express her rage and disappointment at being baffled by the watchful guardians of the unhatched Queen, from whom the hoarse sound comes. In the afternoon of the same day, the last mentioned female left her cell ; we saw her come forth in majesty, finely and delicately

formed, but smaller than the other. She immediately retired within a cluster of workers, and we lost sight of her. Next morning, on opening the shutter of the hive, we perceived a younger Queen rushing apparently in great terror across the surface of the comb, and hurrying around the edge of it to the other side, and in the next moment the other royal personage came in sight, hotly pursuing her rival. We now fully expected to witness Huber's Combat of Queens, and were about to wheel round the hive to witness the affray, when business called us away. In half an hour we returned, hoping we might be in time, but all was over ; the younger queen was lying upon the alighting board on her back, in the pangs of death, newly dragged out by the bees, and doubtless the victim of her jealous senior.

We observed two circumstances respecting these artificial Queens, which may be noticed here, though rather, perhaps, out of place ; one of them agreeing perfectly with the experience of Huber, while the other is at variance with it. While the surviving Queen remains a virgin, not the slightest mark of attention or respect is shown to her by the bees ; not one gave her food, and she was obliged as often as she required it, to help herself, and in crossing to the honey cells for that purpose, she had to scramble, often with great difficulty, over the crowd, not an individual of which got out of her way, or seemed to care whether she fed or starved. But no sooner did she become a mother, than the scene was changed indeed, and they were attesting their affection and regard ; one after another presented her with food, and at every step of her progress, a circle was formed around her by her admiring subjects. The other circumstance alluded to, which varies from the experiments of Huber, respects the vigilance of the workers in such cases, and the sound emitted by the Queens. He says that the workers form no guard around the cells of artificial Queens, and that these last are perfectly mute ; and the naturalist makes some remarks by way of

accounting for it. The above experiments are directly in contradiction to this * The cell of the younger Queen was most strictly guarded, and both emitted the sound alluded to, perhaps once every minute, for several hours together. To these experiments we have only to add, farther, that as already stated, we have very frequently repeated the same operations, with similar success, and that in the summer of 1832, we removed the reigning Queen of the same experimental hive, three times successively, suffering each Queen to remain just long enough to lay a score of eggs before her removal, and each time the workers laid the foundations of five or six royal cells, and brought two or three Queens to maturity. Within the space of six weeks we saw the foundations laid of fourteen or fifteen royal cells, and at the last removal, no fewer than three Queens were visible at the same moment, on the surface of the combs ; yet we had not the good fortune to witness a regular combat between any two of them ; the first hatched of the three we had reason to conclude dispatched two of her rivals, but without our witnessing the deed of death. The third we saw her sting repeatedly, at the instant of the former emerging from her cell, and without any attempt on the part of the others to restrain her. The wounded Queen had strength enough to move a few inches across the comb. when she paused and seemed to sicken from the effect of the venom ; she moved again with a very languid step, an inch or two, and then stopped, her limbs became visibly paralized, and in a few minutes she dropped lifeless to the bottom of

*Both these experimenters may be in the right in regard to the guarding of the Queen cell, whenever the lives of the Queens yet unborn, are in danger from the wrath of the reigning Queen, or several Queens are about to emerge from the cells at about the same time ; many times prior to their swarming, it is the case that there are one or two Queens about hatching, and should the weather be unfavorable, then to prevent the loss of one or two Queens, under these circumstances the workers may be observed guarding the embryo Queen from the old Queen, or keeping the young Queen prisoner until after a swarm has issued, with which the old Queen will go.

the hive. From these experiments, it seems now a fact established beyond all doubt, that bees can at all times procure a Queen for themselves, provided they have a comb containing larvæ not more than three days old, in the common or worker cells, and that nothing but certain important conditions, such as a particular kind of food and more spacious lodgment, are requisite to the conversion of common larvæ into Queens. At the same time it ought to be candidly confessed, that while the fact itself seems now completely established, there are circumstances connected with it which we are unable satisfactorily to explain. That a more abundant supply of food of a more stimulant quality, administered in a cell of larger dimensions, should give full development of organs, which, by the ordinary treatment, would have remained but partially developed, we can readily comprehend ; but that such extra supply of food and space should effect such an absolute change in the anatomical structure and instinctive propensities—should produce a more slender proboscis—deprive the transformed insect of the downy brushes at the joints of her limbs, and the basket-shaped cavities in the posterior pair of legs, for retaining the pellets of farina—and above all, should effect so great an alteration in her instincts, rendering them, in numerous particulars, entirely different from those of the worker class, for which she was originally designed—these are circumstances which, notwithstanding all our researches, are still involved in mysterious obscurity, and furnish ample scope for future investigations.

General Remarks upon the Queen.—It appears from numerous experiments, that the Queen lives to the age of three and four years, but is not to be depended upon as a fertile Queen, over three years, and seldom over two and a half, and that one impregnation is amply sufficient for her whole life, and receiving it from one single Drone.

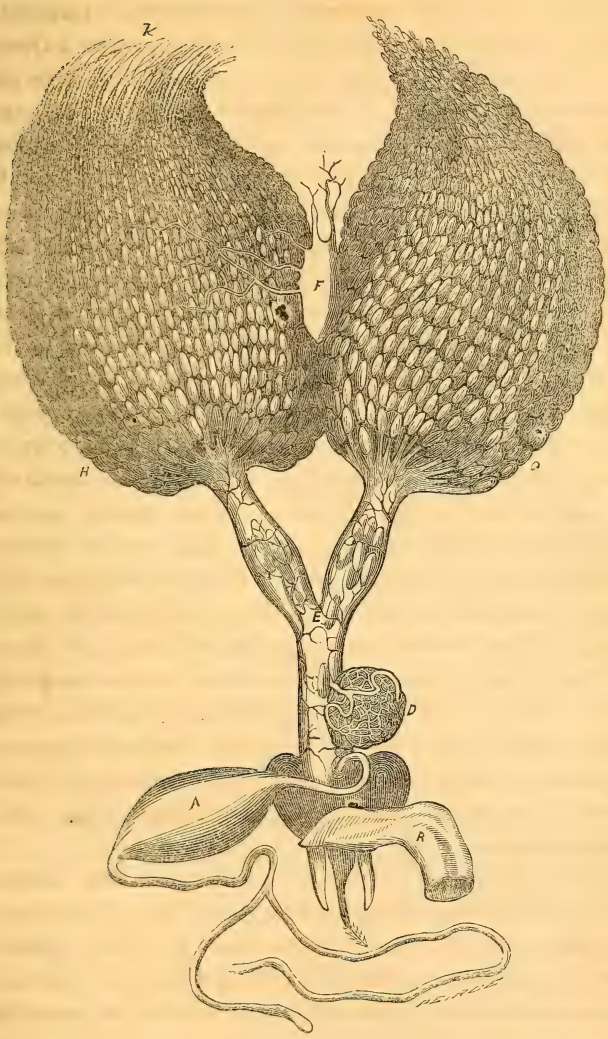


Figure 7.

Ovaries of the Queen.

The female organs consist principally of the *ovaries*, the *ovi-*

ducts, the *sperm reservoir*, and the *ovapositor*. In the *ovaries* the eggs are formed and matured, and remain there until rendered fit for impregnation, and the other circumstances necessary for their maturation, to pass through the *oviducts*. According to Mr. Hunter, what are called *ovaries*, are really *ducts* ; the eggs therefore, are not formed as in other families in a cluster on the back, but in those *ducts*, of which there are several on each side. When full of eggs, they form a kind of quadrangle, these several *ducts* uniting on each side in one *duct ;* this latter enters a common *duct* at E, both sides of which may be called the *vagina*, or *ovapositor*. The common *oriduct* is the canal through which the eggs pass from the *ovaries* to the *ovapositor* The *sperm reservoir* D, is the reservoir in the organ which, according to Herrold, receives the impregnating spermatora of the Drone. A represents the poison bag attached to the sting ; H. C. represents the *ovaries ;* R represents a portion of the *rectum*. The Queen when she deposits an egg in a cell, when the egg passes the spermatheca it receives its impregnation, especially if it is to be deposited in a worker cell ; it is a well known fact that the Queen can deposit an egg in the drone cell, and it will hatch a male without any impregnation at all ; when she deposits an egg in a worker cell, she has to compress her body somewhat on account of the cell being smaller than the Drone cell, and, in fact, smaller than her own body, and in so doing, when the egg passes the *spermatheca*, it receives its impregnation. For farther particulars, see chapter on Queens, Impregnation, Artificial Queens, &c.

CHAPTR IV.

Architecture of Bees.

The peculiarity of instinct in the different orders of animals, if pursued through all its variations, would supply us all with an inexhaustible fund of admiration and instruction; and in none of the lower animals is this wonderful faculty more worthy of our notice and investigation, than in the Honey Bee. So much has already been said and written on this particular point, that the subject is pretty nearly exhausted. We should perhaps find, notwithstanding, but little difficulty in treating our readers with an additional disquisition on the same subject, but as we do not pretend to be able to give a more satisfactory elucidation of the mysteries of animal instinct, than has already been furnished by worthy writers upon Apiarian science, who are well entitled to our respect, we shall restrict ourselves to one or two brief remarks, having special reference to this chapter. It has been said of instinct generally, that, taking the least out of its way, it seems an undistinguishing, limited faculty, and blind to any circumstance that does not immediately respect self-preservation, or support of the species. As far as the instinct of bees is concerned, this maxim must be taken in a qualified sense, for there are numerous instances in the proceedings of this insect in which instinct *does* vary, and conform to the circumstances of place and convenience ; and in no part of their economy do we see more striking instances of this half reasoning faculty, than in their architecture. In ordinary operations, such as collecting their food, feeding their young, following their Queen, &c., they are prompted doubtless, by pure and simple instinct. In avoiding danger, and in return-

ing to the spot where food has formerly been provided for them, they seem guided by an exercise of memory, a faculty which they appear to possess in a considerable degree. But in adapting their waxen structures to change of circumstances, and so as to overcome any artificial obstacles; in building comb *upwards*, contrary to their natural mode of procedure; in building laterally, when unable to find a sure foundation for their works, either above or below, *curving* their combs, and constructing them *angularly*, when avoiding some interposing substance having a smooth or glassy surface;—these are results which seem to manifest something more than simple instinct; they afford a wonderful proof of the resources of this faculty when compelled to deviate from the ordinary course; they imply, in fact, the possession of a certain degree of intellect, or of reasoning power, by which their instinct is modified and counteracted. We cannot, indeed, but be filled with astonishment, when we see their ingenious expedients in getting the better of difficulties which would not have occurred in their natural state, and with admiration of the wisdom and goodness of the Almighty Parent, so conspicuously visible even in the unconscious instinctive operations of these tiny creatures of His hand.

The material of which the bees construct their beautiful combs, which deserve so much admiration, is wax, the nature and production of which will be mentioned and discussed in another chapter. No sooner has a swarm of bees been safely lodged in a hive, than the industrious laborers commence the operation of building. One portion of the population employs itself in cleaning out the new abode, whilst a large number of them hasten to the fields, some of them to collect honey, the saccharine part of which is the source of the wax used in constructing the combs, together with propolis, which is a tenacious substance (see chapter on propolis,) employed in fixing the less adhesive wax to the roof of the hive, and stop-

ping up cracks and crevices that may give entrance to vermin, rain, or cold. On their return, those that have been occupied in collecting honey, cluster closely together at the top of the hive, and, suspended from each other by their hooked claws, form a variety of fantastic, and often graceful figures, such as festoons, curtains, chains, ladders, &c., crossing each other in every direction. They seem sunk into profound inactivity, which continues about twenty-four hours. The inactivity however, is only apparent; the time which they pass in this seeming repose, is doubtless necessary for the elaboration of the wax. But in the center of the mass, one worker has left its fellows and laid the foundation of its future structure; it is succeeded by several others, each of whom singly and separately contributes its quantum of material and skill, to the rising edifice, while succeeding bands of nurse-bees busy themselves in finishing, and polishing the work which the wax-workers have left in a rough unpolished condition; for it is to be observed that in the construction of the combs, the two classes, *wax workers* and *nurse-bees*, have their distinct and separate provinces; the wax-workers are to supply the rough materials and attach them closely together, and the nurse, or finishing-bee, finishes and perfects the edifice; and while these last are occupied in the more refined operations of finishing and polishing, the former, like industrious laborers, are continually bringing forward additional loads of material. One comb is scarcely begun, or contains not more than two or three rows of cells, when the busy architects proceed to lay the foundation of others, on each side of the one already founded, continuing their operations in this manner, till they have taken the whole range of their building ground; and, with such diligence do they ply their labors, that in one day, during the height of the honey season, they will construct from four to five thousand cells. A comb measures in thickness, generally speaking, one inch,

and the interval between combs, is usually about one-third or three-eighths of an inch, affording a passage for two bees to pass each other back to back, without obstruction or inconvenience. These dimensions, however, are varied according to circumstances. At the top of the hive the comb is usually much thicker, consequently the road-way is contracted. This is no inconvenience to the bees, for after the honey-cells are sealed, they have seldom occasion to visit that quarter of the hive, and can, therefore, put up with less room there. When the breeding season returns, however, these cells are all reduced to their original size, if emptied of their contents, and thus fitted for the reception of brood.* The combs, attached as they are to the roofs of the hive descend vertically. Unlike human builders they begin their work at the top of the building or ceiling, and suspend their structure from above. This is their usual method of procedure, but circumstances sometimes induce them to vary from this rule. The following is an instance from our personal observation: We put a swarm into our experimental hive, which is so thin as to admit of only one comb being constructed. Its confined limits prevented any considerable number of bees from working at the foundation of the comb above. A large portion of them began a comb, or rather two, on the rod which crosses the middle of the hive, and thus two combs were constructed at the same time, both of which ultimately became one. It appeared, however, that there was still a want of room, and of employment for those willing and industrious laborers; for to our surprise, a portion of them began a comb on the upper side of the cross rod, and, contrary to their natural mode of proceeding, worked upwards, so that in a short time the upper comb and the central piece met, and the whole formed ultimately, one solid square. The surface of a new

*See Chapter on Hives, where we have a better way than to allow the bees to attach their combs to the roof of the hive.

comb is not quite flat, but perpendicular; that is its thickness decreases towards the edges, and consequently the latest made cells are shorter or shallower than the others. So long as the comb has not reached its utmost limits, this shape is preserved; but when the bees have no more room for its enlargement, they make all the cells of equal depth, and thus it obtains two flat equal surfaces, which it will continue to retain unless in other circumstances. Should it be broken by any means, the edges of what remains must be reduced again to its perpendicular shape, before the bees can repair the structure, and prolong it to its former dimensions. This happens also when the hive is enlarged, by giving it what is called in Scotland, an *eek* or addition below. Previous to availing themselves of the added room, the bees reduce the thickness of the edges of the combs. When new, the combs are of a remarkably pure white color, but soon assume a yellowish hue, and when a year o'd, are of a deep brown. This discoloration is believed by many to arise from the vapor or heated air of the hive; but it is attributed by Huber, erroneously we think, to some direct action on the part of the bees, which are seen frequently rubbing the surface of the comb with their fore feet. In the construction of the cells, the bees adopt the hexagonal form, consisting of six equal sides, and begin their operations at the bottom, prolonging by degrees the pannels or sides. The bottom of the cells are composed of three rhombs or plates of wax, in the shape somewhat of lozenges, or card-diamond seeds, and disposed in such a manner as to form a hollow pyramid. "The apex of each pyramidal bottom, on one side of the comb, forms the angle of the basis of the three cells on the opposite side, the three lozenges respectively concurring in the formation of the braces of the same cells." The whole structure is so delicately thin, that it takes half a dozen of them when placed side by side to equal the thickness of a sheet of paper. But, by the admirable disposition and arrangement of its parts, "each

cell, separately weak, is strengthened by coincidents with others. The bottom of each cell rests upon three partitions or panels of opposite cells, from which it receives a great accession of strength." Besides, each cell is strengthened at its mouth, by a strong thread formed of the mixture of wax and propolis, soldered to the inner surface or edges, and giving it, by filling up the angles, a circular form. This gives great solidity to the fabric, and prevents the mouth of the cell from being easily injured by the unceasing ingress and egress of the bees.

It is remarksble that the cells of a honey comb, including the hexagonal sides, and its pyramidal basis, is the figure of all others, the best adapted for containing the greatest possible quantity, in the least possible space, and with the least expense of material. "There are only three possible figures of the cells," says Doct. Reid, "which can make them all equal and similar without any useless insterstices. These are the equilateral triangle, the square, and the regular hexagon." Of these the hexagon is best fitted for the bee-cell, for it unites to the requisites stated by Doct. Reid, economy of material, and a figure better adapted to the shape of the insect. This latter property would have been possessed in a greater degree by the cylindrical form, but it would have left a space between every three contiguous cells. The square and the triangle would have left no insterstices, but would have consumed more wax, and been ill-adapted to the shape of the bee. The hexagonal form employed, embraces all the requisites; for, together with a convenient figure for the reception of the body of the insect, it secures economy of material, and economy of space, both as respects the number of cells contained in a comb, and the internal capacity of each. The same, if possible, still more admirable skill and arrangement, are displayed in the basis of the cell. The three rhombuses of which it is composed, have the two ob-

tuse angles, each of 110 degrees, and, consequently, each of the two acute angles of 70 degrees. This measurement was taken by Maraldi, and it was verified by Kœnig, a celebrated mathematician and pupil of Bernouilli, who, on being desired by Reaumur to calculate the quantity that should be given to this angle, in order to employ the least wax possible in a cell of the same capacity, found that the angle in question ought to be 109° 26', or 110° nearly ; the very angle which the insect adopts. What a surprising agreement ! A difficult mathematical problem is proposed for solution to a man of profound science, and it is found that an insect, called the *Honey Bee*, instructed by the Fountain of Wisdom, has anticipated the calculations of Geometry, and practically exhibited in its waxen structures, the same conclusion precisely, which the philosopher arrived at only by the exercise of considerable ingenuity and deep thought ! The calculation has also been verified by a distinguished Geometrician, Maclaurin, who very justly observes, that "the bees do truly construct their cells of the best figure, not only *nearly*, but with exactness ; and their proceedings could not have been more perfect from the greatest knowledge of geometry." "After all," as Doct. Reid remarks, "the geometry is not wholly in the bee, but in the great Geometrician who made the bee, and made all things in number, weight, and measure." The cells in a honey comb are of different dimensions, according to the different classes of bees of which they form the birth-place. Those of the workers are in depth about five lines, or less than half an inch, and in diameter two and two-fifth lines. Those of the males are between six and seven lines in depth, and 3 and one-third in diameter ; taking thirty-two of them to make a square inch, including both sides of the comb, while of the worker cells it takes fifty to make an inch. Both of these are ultimately employed as receptacles for storing honey. The male or drone cells are

few compared with those of workers, which last, generally compose the whole of the central portions of the hive, while the drone cells are most frequently constructed in the extremeties of combs, at some distance from the center. It is curious to note the proceedings of bees when about to pass from the construction of worker cells to those of drones. They do not all at once commence the latter of their full diameter; such a proceeding would utterly disorder the delicate arrangement of the basis of the cells; but they build a few rows of intermediate cells, whose diameter augments progressively, until they gain the proportion required. And in returning to those of workers, a similar gradation is rigidly observed. The irregularity apparent in these transition cells, has been accounted a defect; it is, on the contrary, an additional instance of that wise instinct which teaches them to quit the ordinary mode of proceeding, when circumstances demand the construction of enlarged cells, and after building thirty or forty rows of them, to return to the proper proportions from which they have departed, by successive reductions. Both of these kinds of cells being nearly horizontal, it may seem surprising that they can be filled with, and retain the honey fluid. The fact is, however, that they are not horizontal, but are elevated at an angle of never less than 5° and sometimes, when the honey is rendered peculiarly thin by the warmth of the season, and the internal heat of the hive, at not less than from 15° to 20° above the level of the horizon. We have often observed in the month of July and August, when the weather was very favorable for the storing up of honey, and the secretion of wax, the bees eagerly engaged in forming cells designed for honey only, and differing materially from those which were, in the first instance, for the reception of eggs. The texture of the former is thinner, and their strength much greater, and as honey at this season of the year is very thin and fluid-like, these cells are by a wise in-

stinct, made with a much greater dip, or inclination, than the ordinary ones, that there may be less risk of the honey running out before the cells are sealed over. Doubtless, also, the honey is prevented from escaping partly by its own viscusity, and partly by the force of capillary attraction. For if we carefully examine a cell when nearly full, it will be observed that the surface of the fluid is nearly concave, from its adhesion to the side of the cell. It will also be observed how ingeniously the bees seal up their treasure. They first form a ring of wax around the inside of the mouth of the cell, and to this first ring additional ones are supplied, as the increased deposit of honey renders necessary, until at last the opening is completely sealed up by a succession of concentric rings. Besides the cells of workers or males, we find during the swarming season other cells, to the number of six, eight, ten, or even twelve, differing altogether from those first named. These are the royal cells or cradles for the infant queens. They are found almost always upon the edges of the combs, of such particularly as extend but half way across the interior. These cells are constructed, not entirely of wax, Mr. Hunter thinks, but of a mixture of that substance with farina. Their position is almost vertical, and somewhat resembling a hanging acorn. Their dimensions are about one inch in length, and about one-third of an inch in diameter.*

Their oblong cylindrical form, smoothly polished within, and covered externally with a kind of net-work, gives them

*After the Queen has emerged from the cell the workers usually gnaw them away, so there is nothing left of them to show their locality only a waxen cup, resembling somewhat the shell of an acorn, which can be noticed in almost any hive that is over a year old, when taking them up in the Fall after giving them a dose of brimstone, as many bee keepers do, for the sake of getting a few pounds of sulphur-scented honey. See chapter on Hives and surplus honey, where brimstone is never administered.

the resemblance of a suspended stalactite, and announces a particular destination. In fact, the imposing appearance of this cradle, and the profusion of materials expended on it, which is such that one of them out-weighs a hundred common cells, point it out as destined for receiving the most important personage of the whole colony, the Mother and Queen.

In the architectural operations of bees, the *modus operandi* has been minutely detailed in the writings of Huber and other celebrated naturalists. Their observations and discoveries on this branch of natural history are calculated to excite the deepest interest, and we regret that our limits oblige us to forego the pleasure of recording from them many valuable extracts. We cannot, however, omit one extract from the celebrated Huber, which strikingly proves, that though the bees when left to themselves regulate their operations with perfecty uniformity, they are yet capable of modifying them in particular circumstances.

"Having seen bees," says he "work both upwards and downwards, we wished to investigate whether we could compel them to construct their combs in any other direction. We tried to confine them with the hive glazed above and below, so that they had no place of support but the upright sides of their dwelling; lodging themselves in the upper angle, they built their combs perpendicular to one of these sides, and as regularly as those which they usually built under a horizontal surface. I now put them to a still greater trial: as they now testified their inclination to carry the combs in the shortest way to the opposite side of the hive, for they prefer uniting them to wood, or a surface rougher than glass, I covered it with a pane of the glass. Wherever this smooth and slippery substance was interposed between them and the wood, they departed from the straight line hitherto followed, and bent the structure of their combs at a right angle to what was already made, so that the pro-

longation of the extremity might reach another side of the hive which had been left free. Varying this experiment after several fashions, I saw the bees constantly change the direction of their combs; when I approximated a surface too smooth to admit of their clustering on it, they always sought the wooden sides. I thus compelled them to curve the combs in the strangest shapes, by placing a pane of glass a certain distance from their edges. These results indicate a degree of instinct truly wonderful. They denote even more than instinct; for glass is not a substance against which bees can be warned by nature. In trees, their natural abode, there is nothing like it or that resembles it, or with the same polish; the most singular part of their proceeding is changing the direction of the work *before arriving at the glass*, and while yet at a distance far enough from it to allow them to do so. Do they anticipate the inconvenience which would attend any other mode of building? No less curious is the plan adopted by the bees for procuring an angle in the combs; the wonted fashion of the work, and the dimensions of the cells must be altered. Therefore the cells upon the upper or convex side of the comb are enlarged; they are constructed of three or four times the width of those on the opposite surface. How can so many insects, occupied at once on the edges of the combs, concur in giving them a common curvature from one extremity to the other? How do they resolve on establishing cells so small on one side, while dimensions so large are bestowed on those of the other? And it is still more singular that they have the art of making a correspondence between cells of such reciprocal discrepance; the bottom being common to both, the tubes alone assume a taper form. Perhaps no other insect has afforded a more decisive proof of the resources of instinct, when compelled to deviate from the ordinary course. It is singular that though the construction

of the cell of the honey comb, so geometrically just, and so well adapted to produce the greatest capacity at the least possible expense of superficial extent, or of materials, has been long an object of general admiration, one naturalist, and he of no mean celebrity, affects to disdain partaking of this almost universal feeling. Buffon, as if to evince his superiority to what he considers the vulgar enthusiasm excited by the architecture of the bees, declares that "these bee-cells—these hexagons so much applauded and admired, seem only to furnish us with a new argument against enthusiasm and admiration. This figure correctly regular and geometrical as it appears to us, and as it actually is in theory, is, in this instance, but the effect of a mechanical result, which is often found in nature, and may be observed even in the most inanimate productions. Crystals, and several kind of stones, and some kind of salts, assume constantly this in their conformation. Let a vessel be filled with peas, or rather with some seeds of cylindrical shape, and let it be closely shut after having put in a sufficient quantity of water to fill up all the intervals between the seeds; let this water be boiled, and all the cylindrical seeds will become columns of six sides. The cause, it is evident, is purely mechanical. Every cylinder-shaped seed tends by its swelling to occupy the greatest possible space in a given space, they become, therefore, necessarily hexagons by reciprocal compression. In like manner every bee seeks to occupy the greatest possible room in a given space; it is therefore, necessary here also, since the body of the bee is cylindrical, by reason of the same reciprocal compression." To this reasoning it may be answered, that there is no analogy between the cases. A hive without comb, as Lombard argues, is not above one-fourth filled with bees, and there is no cover, as in the case of the vessel to keep the mass together. To make the cases perfectly similar, and fit subjects of comparison, the vessel with water

ought to be filled to the extent of one-fourth, and in that case the cylindrical seed will not be converted into hexagons. Besides the cells at the extremeties of the combs, though not so deep as those at the center or top, are as exactly hexagonal in their forms. Now, if hexagons are formed by the reciprocal compression of the bodies of the bees against each other, how does it happen that the cells at the extremeties, which are not attached to the sides or bottom of the hive, and where consequently there can be no reciprocal compression, should yet be as perfect hexagons as the rest. And, not to dwell on other proofs, adduced by Lombard and other writers, of the utter insignificancy of this naturalist's theory, the cells have not all the same figure, the same dimensions, depth and diameter, which they would necessarily have, if they had been produced merely by reciprocal compression. No ; the work of the bee demonstrates intelligence ; or, if we please, an instinct superior to that of most animals ; and what is this instinct but the teachings of the Almighty ?—a manifestation even in the organization of a creature so unimportant as a tiny fly, of his eternal wisdom, which can render an insect of the earth an object of wonder to man himself, with all his boasted endowments, and which, while it guides the planets in their course and sustains and upholds innumerable myriads of rational and immortal beings, directs the minutest alimalcule to do those things that are necessary to the preservation and comfort of its existence.

The following beautiful lines by Professor Smyth, are extremely applicable to this part of a bee's labor :

" Thou cheerful Bee ! come, freely come,
And travel round my woodbine bower ;
Delight me with thy wandering hum,
And rouse me from thy musing hour,
Oh ! try no more those tedious fields,
Come taste the sweets my garden yields ;
The treasures of each blooming vine,
The bud, the blossom, all are thine.

CHAPTER V.

The Brood of the Honey Bee.

Of the Brood. In forty-six hours after the impregnation, the queen-bee, as already noticed, begins to lay eggs of workers, and continues to do so, usually without interruption, throughout the season, at the rate of one and two thousand eggs per day. This great laying, of course, takes place in the months of May, June, and July. If the bees are kept in a warm place through the winter, and a strong colony, they will commence breeding much earlier. In warm latitudes, bees breed rapidly the year round. Bees can be induced to commence breeding much sooner, if properly attended to by their keepers. (See chapter on Wintering and Early Breeding, Feeding, &c.) When cold weather intervenes, the queen's operations are suspended in a measure, and the hatching of the eggs already laid very much retarded. The fruitfulness of the mother bee is indeed astonishing.

It does not often happen that the Queen has a sufficiency of room, so that she can go and deposit several thousand eggs at a time. If it is a young swarm, she cannot deposit eggs until the working bees get the comb built. As soon, however, as there is room to deposit eggs, she will readily do so, providing she is a fertile Queen, and the honey-gatherers do not get the start of her, and deposit honey and bee bread in the cells. It is the case many times, in the height of the honey season, that the bees gather the honey so fast that the Queen does not get a chance to deposit many eggs under several days after taking possession of a new hive. But, when bad weather comes on, so that the bees cannot go to the

fields for honey, then they turn their whole force to building comb. At such times the Queen gets a chance to deposit her eggs in large numbers. In the height of the honey season the bees build much of their comb in the night. Be it remembered that the old Queen, of the parent hive, lays all the eggs that produce the first, second and, sometimes, third swarms; and when a new swarm is thrown off, the old Queen is invariably the one to accompany it, and consequently lays all the eggs that hatch for nearly fifty days, in that hive, whether they throw off a swarm or not. If there is a swarm to issue from this second swarm, this same old queen is the one to emigrate with it, thus making two emigrations in one year.

It has been computed by the celebrated Naturalist, Schirach, that the number produced in a hive by one Queen, during the laying season, amount to one hundred thousand (100,000). This statement should convince any one, after seeing the Queen (through a glass hive) deposit five or six eggs per minute, as many observers have done. In the beginning of the season, or rather year, it is a good stock hive which possesses a population of 20,000 or 30,000, yet that some hives shall in June throw off swarms amounting to 40,000 or 50,000, in many cases the last, or second swarm, amounts to 10,000 or 12,000, and still at the end of harvest, this original stock-hive shall exhibit a population of 20,000 or 30,000; add to all this that in many instances a first swarm throws off one or two colonies, and add these together and it would overrun a hundred thousand. Before depositing her eggs, the Queen carefully examines the cell, inserting her head into it and keeping it there for a second or two, and as already stated, after having deposited a few eggs on one side of the comb, proceeds to the other side, and with a view probably of economizing heat, supplies the corresponding cells upon that side. Her impatience or necessity to commence laying

is such, that in a newly established hive, eggs will be found before there is three inches square of comb (provided she gets ahead of the honey-gatherers,) constructed, and even before the cells have attained their full depth. And in a well-peopled hive, even during winter, and while the temperature is chilled by the frost and snows of January, and the bleak winds of the following month, the indefatigable mother bee is found busied in depositing eggs. We have said that the Queen begins laying eggs forty six hours after impregnation. This does not hold true invariably ; a sudden change of temperature may prolong the interval to a very considerable extent. Huber had a Queen impregnated in October, which, on account of the inclemency of the season, did not commence laying until the following Spring. The eggs, when layed, remained fixed on the superior angle of the cell, to which they are attached by a viscous matter covering them for three days ; on the fourth, the shell or thin enveloping membrane bursts, and a small lively worm is deposited at the bottom of the cell. The nurse bees immediately enter upon their vocation, and administer a copious supply of liquid food, of which honey and farina, and probably water, are the principal ingredients. As the larva increases in growth, the attention of the bees in nourishing it is augmented, and indeed unremitting ; for, at whatever time we inspect a brood comb, we shall observe hundreds of nurses with their bodies inserted in the cells, supplying the wants of the infant progeny. Although in the vermicular state, and consequently without feet, the larva are capable of moving in a special direction. During the first three days their motion is so slow that it is scarcely perceptible, but it afterwards becomes more evident, and they have been observed to perform two complete revolutions in less than two hours. The slightest movement of the bees approaching to administer to their wants, is sufficient to attract them to their food, which they devour most vora-

ciously, and it is unsparingly administered to them. At first the liquid is nearly insipid, but acquires gradually a perceptible flavor of honey, and becomes more saccharine and transparent in proportion as the larva advances in growth. "It is indescribable," says Februrier, "the care which the workers lavish upon these little nurslings, towards whom they seem to cherish the tenderest attachment. A comb filled with brood and placed in an empty hive, seldom fails to retain them there to the utter disregard of the loss of their stores. The tenderest mother could not watch over her children with more affection, nor supply them with nourishment more impartially, or in greater abundance. At the same time, it is done without waste, for the quantity is so proportioned to the demand, that none of it remains in the cells when the larva undergoes its transformation to the nymph state."

At the moment of being hatched the insect presents the appearance of a straight worm composed of several ventral wings. It quickly grows so as to touch the sides of the cell, when it contracts its body and coils itself into a semicircular figure, and continues enlarging its dimensions until the extremes meet, and form a complete ring. In this state it continues receiving food from the nurses for five days, when it ceases to eat; its supplies are of course cut off, and the bees proceed to seal up the cell with a waxen cover of a brownish color, and slightly convex. Thus left to itself the larva begins spinning around its body, after the manner of the silkworm, a fine silken film or cocoon, which completely envelopes it. "The silken threads employed in forming this covering," Kirby and Spence tell us, "proceeds from the middle part of the under lip, and is in fact, composed of two threads gummed together, as they issue from the two adjoining orifices of the spinner." In the formation of its cocoon, the larva occupies thirty-six hours, and in three days after it is

metamorphosed into a nymph or pupa, terms applied to the mummy-like state to which the larva is subjected, previous to its becoming a perfect insect or image, as it is termed. During this state of concealment, various changes happen to the enclosed insect. The first change in its situation is its ceasing to continue in that coiled position in which it originally lay at the bottom of the cell, and extending itself along its whole length, with its head in the direction of the mouth of the cell. The head begins to appear from the inert looking mass, having a small protuberance, probably the rudiment of the proboscis ; the first indications of the feet also appear, though of diminutive size. After the head is formed and theproboscis prolonged, all the other parts display themselves successively; and the worm is changed into the perfect insect, except that its outer covering is yet white and soft, and has not that dark scaly texture which, as a proper coat of defence, it afterwards acquires. By this transformation the larva becomes divested of its cocoon, which is attached so closely to the internal surface of the cell, that it appears to form part of its substance, and adds considerably to its thickness ; these linings are sometimes formed to the number of seven or eight, and many times where the combs are old, to four timbes that number ; adhering to the sides of the cells and having an injurious effect as they do, on the cell's capacity, and exciting, by their strong smell, the attack of moths and other enemies. The number of linings found adhering to a cell and which may be disjoined by soaking the comb in water, indicates the number of bees of which it has been the birth-place. The late Dr. Barclay, of Edingburgh, imagined he had discovered that the partitions of the bee-cells are *double*, and regarded this circumstance as an additional instance of the wonderful architectural powers of bees. It is not improbable that what he considers to be separate laminæ of wax are but the silken linings of the cells. The

bee thus stripped of its silken covering and having all its parts unfolded by degrees, and changed, through a succession of colors, from a dull white to a black, thus arriving at the state of a perfect insect, which will be from the 20th to the 21st day, reckoning from the minute the egg is layed, if it is a worker. She then commences eagerly the operation of cutting through the covering of her cell with her mandables, and in half an hour succeeds in escaping from her prison. On quitting her cradle she appears for a few moments drowsy and listless, but soon assumes the agility natural to the race, and on the same day on which she has emerged from her cell, does she many times set out with her seniors to engage in the labors of the field. Some of the ancient bee-keepers enlarge on the attention paid by the seniors to the young worker, on emerging from her cell ; describing them as licking her body, supplying her with food, and seeming to instruct her in what is necessary to render her a useful member of the community. These descriptions have been repeated by succeeding writers on the subject, and the existence of these amiable traits in the kind nurses of the young, is taken for granted as an indubitable fact in their natural history. We have reason, in consequence of repeated observations, to disbelieve the alleged fact, and must, in accordance with the truth, withhold from our favorites the unmerited eulogizing they have received on this head. They are in fact, in this particular, harsh and unfeeling in the extreme. In hundreds of instances have we seen and pitied the infant insects, when, after having long struggled to get out of its cradle, it has at last succeeded so far as to extrude the head, and when laboring with the most eager impatience, and on the very point of extricating the shoulders also, which would at once secure its exit, a dozen or two of workers in following their avocations, trample without ceremony over the struggling creature, who is then forced for the safety of its head to pop quickly dow

into its cell again, and wait till the unfeeling crowd pass on, before it can renew its efforts to escape. Again and again are the same impatient exertions repeated by the same individuals with similar mortifying interruptions, before it succeeds in obtaining its freedom. Not the slightest attention or sympathy is observable on the part of the workers in these circumstances ; nor did we ever in a single instance, witness the kind parental cares which seem to owe their existence to the fancy of the writers alluded to. During the larva stage, as we have shown, the solicitude of the workers about the wellfare and nourishment of their infant charge, is extreme ; but from the moment they have sealed up their cell, and while the larva is undergoing its transformation, they seem to cease from any thing like individual attention, and though when a brood comb is meddled with their utmost ire is kindled against the invaders, as far as concerns the reception of the newly hatched insect, and its introduction to the duties and avocations of the bee-community, they appear altogether selfish and indifferent. There is another case where this indifference appears very striking : a sudden change of atmosphere about the end of Autumn, from a mild temperature to frost, has such an immediate effect on the brood, that it is not uncommon for a young bee which has so far succeeded in breaking its prison as to extricate its head, and nearly its shoulders, yet perishing from cold in this situation, without the slightest effort on the part of the workers to save the life of a companion whose rearing has already caused them so much labor. Immediately after the young bee has issued from the cell, the workers hasten to clean it out, clear away the ragged remains of the cover, fortify it anew with the usual strong bordering of wax, and thus prepare it for the reception of another egg, or of honey or farina.

We have hitherto confined our observations to the progress of a worker from the egg to the state of the perfect insect.

The same process takes place in case of the male and of the Queen, though with some difference as to the time occupied in the transformation; like those of common bees, the eggs of the male are hatched in three days, the larva state continues six and a half days, and after having formed their cocoon and been metamorphosed into nymps, they attain to the state of perfect insects on the 24th day from the laying of the eggs. We may briefly notice, here, the statemeat of Huber respecting the order in which the different kinds of eggs are arranged in the ovarium of the Queen, and the law which regulates her laying. He says, "Nature does not allow the Queen the choice of the egg she is to lay;" that "it is ordained she shall, at certain times of the year, produce those of males' and, at another time, the eggs of workers; an order which cannot be inverted;" that "the eggs are not indiscriminately mixed in the ovaries of the Queen, but arranged so that at a particular season, she can only lay a particular kind;" that "she can lay no male eggs until those of the workers, occupying the first place in the oviducts, are discharged."

We think that Huber's statement upon this point will not hold true in all respects, and we think it made in terms too unqualified, and that there are palpable and frequent exceptions. Perhaps he did not, in his series of experiments, put a young fertile Queen into a hive where there were no drone cells, but all worker cells, as some experimenters have done, and the progeny of the Queens under these circumstances were all worker bees, with the exception of what were converted into Queens; and, on the other hand, put a colony of bees into a hive containing drone comb only, and in this case her progeny were all drones, unless the bees tore out a portion of it, and reconstructed worker comb. The instinct of the bee is such that they will invariably do this, when compelled to do so, and that the sex of the bee is determined by the place where the egg is deposited. The

Queen has no control over the eggs in her ovarium, farther than she can lay eggs in cells, or extrude them upon the edges of the comb, as she sometimes does, when there are no cells for the reception of her eggs, and thus to be devoured by the greedy workers. If the Queen is compelled to lay in drone cells, the number of eggs will be limited to what they would be in worker cells, knowing, as she does, that too many drones would be the destruction of the whole colony in a short time.

Now, does not this fact seem to imply that there is no such arbitrary arrangement of the several kinds of eggs, as Huber imagines? And, if it would not be stretching the inference too far to say that the Queen has the power of laying those of males or of workers, as the circumstances may require, does it not imply that the statement of Huber may admit of very important and frequent objections?

"About the twentieth day," says Huber, "from the commencement of laying of male eggs, the bees begin to lay the foundations of royal cells, and the Queen having resumed laying female eggs, deposits them, at intervals of one or two days, in these cells, from which are hatched, in due time, other Queens. This regular process is, however, sometimes interrupted. If the Queen be not a fertile one, and the colony, is, in consequence, weak in population, if the hive or domicil itself be large in proportion to the number of its inhabitan's, or, if the temperature of the season has been such as to interfere with the copious collection of honey and farina; in these circumstances no male eggs will be layed, no royal cells founded, and no swarms will issue. But in favorable circumstances the laying of royal eggs takes place regularly during the laying of those of males, and swarming is the consequence.

The royal cell is an inch in depth, and it has been considered difficult to comprehend how the body of the Queen can reach

the bottom, so as to attach the eggs to it; but in fact, the Queen lays when the cell is newly formed, and not deeper than that of a common bee, and it is not until after the precious deposit has been made, that the workers lengthen it to the full size. The egg destined to produce a Queen, like that which is lodged in a drone cell, and that of a worker, is three days old before it is hatched; as soon as this takes place the royal larva becomes an object of devoted attention to the bees, who watch over and feed it with unremitting care. "It is difficult," says M. Februrier, "to form an idea of the anxious care and attention bestowed by the bees on the royal larva. The comparison of the affection of a mother for an only child, can alone form anything like a conception of it. They seem to feel that their own fate is involved in that of their young sovereign; they feed her with a jelly different from that which is destined for the workers and males; it is more pungent and moderately acid, and they supply it in such profusion that she is unable to consume it all, for often, after her transformation, some remains of it are found at the bottom of the cell."

At the end of the fifth day of the larva state, the royal cell is closed, and the inhabitant begins spinning her cocoon. It is worthy of remark, that this covering is left incomplete, like those of the workers and males, which enclose the whole body. This fact beautifully demonstrates the admirable art with which the Author of Nature has connected the various characteristics of this interesting tribe of his creatures. In spinning the cocoon the Queen spends only 24 hours; she remains in a death-like torpidity between two and three days. She is then metamorphosed into a nymph, and after remaining in that state four days and a half, she comes forth a perfect Queen on the sixteenth day.

The royal insect is not permitted to leave the cell and as generally happens, to lead off a new swarm, unless the weather should be very unfavorable; were she to obtain her liberty, while

at the same time emigration was prevented by the state of the external atmosphere, or other circumstances, there would be a plurality of Queens in the hive and mortal strife would ensue. The young Queen, therefore, is detained a captive, and the workers piercing a hole in the cover of the cell, insert their proboscis and supply her with food during her captivity. The number of Queens hatched in a hive in one season, depends principally upon the size of the colony and the number of swarms they throw off; the more times they swarm, the more Queens they rear. In warm climates bees can throw off a colony every three or four weeks the year round, but in a northern climate, like Vermont, they never should swarm more than once, or twice at most; if more than that, it will ruin both the parent and young swarm, nine times out of ten.

"As it is very important," says Huber, "in many experiments to know the exact time that the three species of bees exist, before assuming their ultimate form, I shall here subjoin my own observations on the point;

The worm or larva, passes three days in the egg, and five in the vermicular state, then the bees close up the cell with a wax covering; it now begins spinning its cocoon, in which operation 36 hours are consumed; in three days after this it changes to a nymph or pupa, and passes six days in this form, and on the twentieth day of its existence, it comes forth a perfect winged insect, but sometimes as late as the twenty-first day. The royal worm also passes three days in the egg, and is five a worm or grub, when the workers close its cell, and it immediately commences spinning its cocoon, which occupies 24 hours. The tenth and eleventh days it remains in complete repose, and even much of the twelfth day; then the transformation to a nymph takes place, in which four or five days are passed, and on the sixthteenth day the perfect state of the Queen is attained. The male or drone passes three days in the egg, six and a half as a worm or grub, and metamorphoses into a perfect winged insect on the

the twenty-fourth day from the laying of the egg. The larva of bees are not condemned to remain absolutely motionless in their cells, for they can move in a spiral direction. During the first three days this motion is so slow as scarcely to be perceptible, but it afterwards becomes more evident. I have often observed them perform two complete revolutions in an hour and three quarters. When the period of transformation arrives, they are only two lines from the orifice of the cell. As their position is constantly the same, bent in an area, the larva in the cells of the workers and drones are perpendicular, or nearly so, to the horizon, while those in the royal cells lie horizontal.

Whenever mature bees are discovered in the cells for the space of fifteen or twenty minutes, it is a certain indication that they are taking their repose, as they never enter their cells head-foremost, unless depositing honey, or taking repose; when they hatch they emerge from the cell head foremost. The drones take repose upon the outer portion of the comb; the Queen sometimes takes her repose by crawling into a drone cell; the workers seldom take repose when there is honey to gather.

CHAPTR VI.

Honey Pasturage.

On the different substances found in a Bee Hive. Honey, Wax, Farina or Bee Bread, Propolis or Bee Glue. Honey is well known to be a vegetable product, secreted in the nectaries at the base of the corollæ of the different species of flowers. It has been supposed by some writers to be the elemental principles of all vegetables, without exception, and indispensa-

ble to their existence ; although there is perhaps, no sufficient evidence of the saccharine matter of plants being in all cases convertable into honey. As one of its secondary uses, it seems destined by nature for the food of bees, and those industrious collectors fail not to appropriate the rich liquid. Sweeping the hollow of the honey-cup with their little proboscis, the little skillfull chemists eagerly imbibe the saccharine juice as it exudes from the nectarium, receive it into the honey-bag, which forms their anterior stomach, and hurrying homewards with their precious load, disgorge it into a cell prepared for its reception. The quantity which each bee deposits at one time is very small, the honey-bag when full, not exceeding the size of a small pea; but the aggregate quantity collected by the whole colony, is prodigious. Much has been said both in ancient and modern times, as to the amount of honey a colony of bees are capable of making

1st. Much depends on the size of the colony.

2d. Whether the bees are allowed to swarm or not.

3d. The kind of pasturage or flowers adjacent to the Apiary.

4th. Whether it is a good season for Bees ; that is, whether the weather is favorable to the honey flowers, as they may all be in full bloom and yet the bees not be able to collect any honey; a cool wet season like 1857, in the more northern portions of the New England States, was very unfavorable for the collection of honey, as well as to check the breeding and swarming of the bees. But a warm moist season is most favorable to the honey and honey harvest. Then much depends upon the skill and experience of the bee-master, as well as the kind of hive that may be used, whether the honey yield is great or less.

After taking all these things into consideration, and also, whether it is a cold or warm climate, the bee-keeper will readily discover the reason why his bees will not make honey abundantly at all times and places. If the apiarian has the skill and knowledge in the business that he should have, in order to

be successful, he will readily perceive where he can greatly assist his bees in storing up honey, as well as in brooding, to have them throw off large early swarms, and to have perfect control of them in all the various departments of their labors, by following the directions laid down in this work. We can give no particular amount of honey a swarm of bees should make, as much depends upon circumstances.

I will here state the advantages that may be given to the bees by the use of my Patent Hive. First, you start with a strong healthy colony in the Spring, keep them in a non-swarming hive, (like my last improvement,) furnish them all the comb that they need to store their honey in, *and save them the trouble of making it, as it costs them twenty and many times twenty-five pounds of honey, to build a pound of comb ;* prevents there being any male bees or drones, to eat up the honey ; (as they never make a drop, but consume a large amount of the best honey in the hive,) in preventing their swarming, (see chapter on swarming.) and in using my hive, if it is a good honey season for bees, they will make from two to three hundred pounds of honey in one season, with proper care and management ; thus making your bees pay a much larger per cent. than anything else that is kept on a farm, and with much less care and attention. This amount of honey may seem incredible to many, but nevertheless it is true, for it has been done where bees had all their comb to build, as well as to be troubled with the drones, which ate up a large portion of it ; under all these disadvantages they have been known to store upwards of 290 pounds, notwithstanding the bees had the privilege of swarming. It is a certain fact that a good swarm of bees will store up several pounds of honey in one day. I have had them store up 10 or 12 pounds per day, in the heighth of the honey season, and I have statistics showing that they have stored as high as 18 pounds in one single day. I had one swarm make 125 pounds in eleven days, and there was three days of

bad weather in the time ; it was a young swarm which came out on the 14 day of July, 1857 ; I gave them no particular care or attention during the time. With my Patent Bee Hive Scale, it is easy to ascertain just how fast the bees are making honey at any time, in less than two minutes,and not molest the bees in the least. (See chapter on Hives and management, for particulars of the scale.) We have in a fine summer day, repeatedly counted the bees of a hive as they returned from the fields ladened with sweets, and found the number to be between sixty ahd seventy in a minute. When the cells are full and the watery part evaporated, then the bees seal them over for future use ; it is this evaporation or sweat, that bee-keepers sometimes discover running out of the hives in the height of the honey season. Should they seal the cells over as soon as the honey is put into them, it would, many times, sour and spoil. There is more honey consumed in the months of March and April, when breeding goes on rapidly, than during the four preceding months; at the same time many cells are left open and half filled for daily consumption. It has been a subject of discussion among naturalists, whether the honey after being extracted from the flowers, undergoes any change in the stomach of the insect, before being deposited in the cell. Februrier is of the opinion that it is subjected to the digestive process. The celebrated John Hunter thought it remained pure. and in no respect whatever altered, however long it had been retained in the stomach of the bee ; and he is followed in his conclusions by his countryman, Bonner. Kirby and Spence, entomologists of no mean fame, have adopted the oposite opinion, but it does not appear that they had been led to this conclusion by the result of any experiments instituted for the purpose of ascertaining about the matter correctly. Reaumur, however, tells us, that from his experiments, he was satisfied that a process of elaboration did take place in the food with which he had supplied his bees, and that the sugar with which he fed them had precisely the taste

and flavor of honey. But our experience, if we may venture to differ in the matter, from men so deservedly celebrated for attainments in natural science, leads us, with Hunter and Bonner, to a different conclusion. We have repeatedly tasted the syrup of sugar, which we had seen the bees take from the feeding trough and deposit in the cells, and could never discover the slightest difference in any respect, at least so far as taste and smell were concerned. Perhaps the liquid was clearer, and we sometimes imagined it was; if so, this constituted the only difference. The secretion of honey depends greatly on the state of the atmosphere. During the prevalence of dry easterly winds, the fields present to the bees nothing but barreness; their out-door labors are suspended, and but for the already hoarded stores, the brood would be in iminent danger of starvation. But when the weather is moist and sultry, and the air charged with electricity, the circulation of this vegetable fluid is considerably accelerated, and the bees know well how to avail themselves of so favorable a juncture for collecting their treasure. Huber remarks that the collection is never more abundant, nor their operations in wax more active than when the wind was from the south, the air moist and warm, and a storm approaching; heat too long protracted, however, and its concomitant drought, chilly rains and a north wind, entirely suspend the elaboration of honey in vegetables, and consequently the operation of bees.

The quality of the saccharine fluid is influenced by various causes. Something depends on the particular period of the season that it is collected. In Scotland, Germany and England, the best honey is gathered in the months of June and July; this rule will apply in the United States, especially in the northern portion of them, when the white clover, (*Trifolium repens,*) is in bloom; and what is stored from this alone, generally speaking, is of as much value as all other honey-producing plants put together, up to the month of July; after that time, buckwheat is one of the principal honey-producing vegetables. The quality

of the honey is of course, much influenced by the nature of the plant most frequented by the bees. The famed honey of Hymettus, derives its excellence it is said, from the wild Thyme growing so luxuriantly on the celebrated mountain from which it derives its name. There is a species of white Dutch clover, that flourishes in many parts of the country, being lately introduced among us by the Patent Office department at Washington, that affords large supplies of the best quality of honey; in some parts of Germany and Scotland it has been cultivated successfully for many years, not only for bee-culture and pasturage, but for cattle also.

Instances of honey of a deleterious nature being sometimes met with, we must not pass over wholly the serious and sometimes fatal effects produced upon some persons, by eating poisonous honey, or drinking mead. Says Messrs. Kirby and Spence, "we once knew a lady upon whom these acted like poison, and have heard of instances in which death was the consequence." Sometimes when bees extract honey from poisonous plants, such results have not been confined to individuals of particular habit, or constitution. A remarkable proof of this is given by Dr. Barton, in the fifth volume of the American Phylosophical Transactions. In the autumn of the year 1790, an extensive mortality was produced among those who had partaken of the honey collected in the neighborhood of Philadelphia. The attention of the American Government was excited by the general distress, and a minute inquiry into the cause of the mortality ensued, and it was satisfactorily ascertained that the honey had been extracted from the flowers of *Kalmia Catifolia.* Though the honey mentioned in Xenophan's well known account of the effect of a particular kind of honey eaten by the Grecian soldiers, during the celebrated retreat after the death of the younger Cyrus, did not operate fatally, it gave those of the soldiers who ate it in small quantities the appearance of being intoxicated. and such as partook of it freely, as being mad, or

about to die ; hundreds laying on the ground as if after a defeat. A specimen of this honey, which still retains its deleterious properties, was sent to the Zoological Society in 1834, for their inspection and analization.

We have seen it remarked in bee publications, that the finest honey is got from the young swarms ; this fact is so, generally speaking, but not, as we might naturally be led to infer from the assertion, because it is the produce of young bees, or of fresh swarms; but because bees swarm only at the height of the honey season when the flowers are in their richest fragrance, and because the combs are then new, and have not as yet served as receptacles for the brood. The above remarks apply to the quality of the honey in the state in which it is secreted in the flowers, its after treatment does not improve it. The heat and vapor of the hive are injurious to it ; in very severe seasons it is sometimes candied, and in the honey harvest, when it is being separated from the wax, its purity may easily be injured by imperfect management.

As an article of nourishment to many, honey has been used from time immemorial, whether used separately or blended with other aliments. It was held out to the children of Israel as one of the valuable products of the promised land, and to this day it is highly esteemed in Eastern countries. Among the Greeks and Romans it was highly relished ; they compounded it with other nourishing substances, and even mixed it with their wines. We also learn in the Bible, Book of Judges, in Samson's exploits, of his finding honey in the carcass of a lion. In fact, honey is one of the most delicious sweets we have knowledge of, either in ancient or modern times, and in the earlier periods of the world, it was the only sweet extant. It is nutritious in proportion to the saccharine matter it contains, and is regarded by medical men in many cases of illness, as a great tonic for the stomach. Its use as an article of food, it is true, has been greatly diminished by the use and culture of the sugar cane,

(the Chinese sugar cane included,) but it is still an article of considerable traffic, and large quantities of it are imported into this country from the East and West India islands, and also from Mexico and South America; yet notwithstanding the large amount of honey imported into our country, our native honey bears a good price, as its quality is much better than southern honey, owing principally to the climate and the bee pasturage which our nothern climates afford. The colder the climate the better the honey, as a cold climate is always better for the production of butter and cheese, so it is for honey. I have often heard it remarked by country bee-keepers, that whenever their cows produced well, that their bees invariably did; but I think there are some exceptions to this rule. In 1857 the Eastern States were much more favorable to the production of butter and cheese than for honey, while in the Western States it was quite the reverse, although there is as much difference in the quality of the honey in the two countries, as there is in the pork or butter, or any thing else that the farmers raise in the two places. The best honey produced in the Western States is made from wild flowers of the prairie, which is very similar to eastern buckwheat honey; it has an aromatic smell, is pungent to taste, and is of a redish color; although it looks very nice when made into boxes and fitted up for market, and usually fetches in the market of Chicago, from 25 to 40 cents per pound, yet in the Eastern States it would be called No. 2 honey, compared with the white clover honey, as that is perfectly transparent, and imparts a most agreeable odor and taste. Honey forms, we are told, a very important ingredient in those fine ales which are brewed in Scotland, and certainly it must add not a little to the nutritive qualities of that wholsome beverage.

Remarks on the uses of Honey. It is allowed by all medical men, that honey never should be eaten while new, and in an unsealed state, for honey, especially in an unsealed state, contains many times poisonous properties, and by giving it a little

age, as bees generally do, much of it evaporates ; but notwithstanding the sealing of the cells, it is not proper to eat freely of it unless it is as much as one year old. Many persons can testify to the effects produced by eating too freely of new honey. New honey is the most healthy sweet that can be found, if it is first put into a kettle and brought to a boiling point, and then let cool ; skim off the wax and it is ready for the table. In southern climates new honey is much more poisonous than in colder climates ; in South America and Mexico, honey is always brought to the boiling point before it is used by the natives.

The oleander, (*Nerium Oleander,*) yields a honey that proves fatal to thousands of imprudent flies, but our bees more wise and cautious, avoid it. Occasionally, perhaps, at particular seasons, when flowers are less numerous than common, this instinct of the bees appears to fail them, or to be overpowered by their desire to collect a sufficient store of honey for their purposes, and they suffer for their want of self-denial. Sometimes whole swarms have been destroyed by merely alighting upon poisonous trees. This happened to one in the county of Westchester, New York State, which settled upon the branches of the Poison Ash, (*Rhus Vernix*); on the following morning the imprudent insects were all found dead, and swelled to more than double their natural size.

When the stomach of the bee is filled with nectar, it next by means of the feathered hairs with which its body is covered, pilfers from the flowers the fertilizing dust of the anthers, the pollen, which is equally necessary to the society with the honey, and may be named the ambrosia of the hive, since from it the bee-bread is made. Sometimes the bees are so discolored with this powder as to look like a different species of insect, becoming white, yellow, or orange, according to the flower which it has been feeding upon. Reaumur was urged to visit the hives of a gentleman, who on this account, thought his bees were different from the common kind of bees. He suspected, and it proved so,

that the circumstance just mensioned, occasioned the mistaken notion. When the body of the bee is covered with farina, with the brushes of its legs, especially the hind ones, it wipes it off; not as we do with our dusty clothes, to dissipate and disperse it in the air, but to collect every particle of it, and then to knead it and form it into two little masses, which she places, one in each of the baskets formed by hairs on her hind legs.

Aristotle says that in each journey from the hive, bees attend only one species of flower; Reaumur seems to think they fly indiscriminately from one to another; but Mr. Dobbs, in the Philosophical Transactions, and Butler before him, assert that they have frequently followed a bee in collecting pollen, &c., and invariably observed that it continued collecting from the same kind of flowers with which it first began, passing over every other species, however numerous, even though the flower it first selected was scarcer than others. Their observations, he thinks are confirmed; and the idea seems not unreasonaqle, by the uniform color of the pellets of pollen, and their different size. Reaumur himself tells us that the bees enter the hive, some with yellow pellets and some with red ones, and others again with whitish ones, and sometimes they are even green; upon which he observes that this arises from their being collected from particular flowers, the pollen of whose anthers are of those colors. It seems not improbable that the reason why the bee visits the same species of plants during one excursion, may be this: her instinct teaches her that the grains of pollen which enter into the same mass, should be homogeneous, in order, perhaps, for their more effectual cohesion, and thus Providence also secures two important ends: the impregnation of such flowers that require such aid, by the bees passing from one to another; and the avoiding the production of hybrid plants, from the application of the pollen of one kind of plant to the stigma of another. When the anthers are not yet burst, the bee opens them with

her mandibles, takes a parcel of pollen, which one of the first pair of legs receives and delivers to the middle pair, from which it passes to one of the hind legs. If the contents of one of the little pellets be examined through a lens, it will be found that the grains have all retained their original shape. A botanist, practiced in the figure of the pollen of the different species of common plants, might easily ascertain, by such an examination, whether a bee had collected its ambrosia from one or more, and also from what species of flowers.

In the months of April and May, as Reaumur tells us, the bees collect pollen from morning till evening; but in the warm months, the great gathering of it is from the time of their first leaving the hive, which is as early, many times, as four o'clock in the morning, to about ten o'clock A. M. About that hour, all that enter the hive may be seen with their pellets in their baskets; but during the rest of the day there is but little farina collected. In a hive, however, in which a swarm has been recently established, it is brought in, generally, at all hours of the day. He supposes, in order for its being formed into pellets, that it requires some moisture, which the heat evaporates soon after it is deposited in the hive. When a bee has completed her lading, she returns to the hive to dispose of it. The honey is disgorged into the honey-pots, or cells, destined to receive it, and is discharged from the honey-bag by its alternate contraction and dilation. A cell will contain the contents of many honey-bags. When a bee comes to disgorge the honey, with its fore legs it breaks the thick cream that is always on the top, and the honey which it yields passes under it. This cream is honey of a thicker consistency than the rest, which rises to the top of the cells, like cream on milk; it is not level, but forms an oblique surface over the honey. The cells, as before stated, are near a horizontal position with the mouth of the cell slightly elevated, so that the honey will not run out. Bees when they

bring home the honey do not always disgorge it into the cell, but give it to such of the inmates as have been at work in the interior part of the hive. Some of the cells are filled with honey for daily use. Bees generally seal up their cells as soon as the moisture or watery part evaporates; should they do it before, it would sour in the cells, and thus be spoiled; when the cell is sealed it is craped over with a waxen cover perfectly white. The pollen, or bee-bread, is employed as circumstances dictate; when the bee ladened with it arrives at the hive, she sometimes stops at the entrance and very leisurely detaching it by piece-meals, devours one or both the pellets on her legs, chewing them with her jaws and disgorging a small portion of honey, as this is the way they prepare the farina for the young brood. Sometimes she enters the hive and walks upon the combs, and, whether she walks or stands, still keeps beating her wings. By the noise thus produced, which seems a call to her fellow citizens, three or four go to her and placing themselves around her, begin to lighten her of her load. When more pollen is collected than the bees have immediate occasion for, they store it in some of the empty cells. I think the assertion involved in much doubt, that one bee feeds another, unless it is a young bee not yet mature. The bees all pay that respect and homage to their Queen by offering her food almost constantly. The laden bee puts her two hind legs into the cell, and the intermediate pair pushes off the pellets; when this is done, she or another bee, if she is too much fatigued with her day's labor, enters the cell head first and remains there some time, engaged in diluting the pellets, kneading them and packing them close, and so they proceed till the cell is filled. A large portion of the cells in some hives are filled with this bread. The bees usually fill the cells with farina only one half or two-thirds full, then to keep it moist fill it up with honey; in this way it can be kept a long time, and many

times it accumulates so fast that the hive is frequently one-half or two-thirds full of this substance, especially if it be an old hive ; when this is the case the swarm will soon go to destruction, as the Queen has no place to deposit her eggs, on account of the cells being occupied by an over-stock of bee-bread, and the longer it remains in the hive the worse it is, as the bees never remove it after once it has been deposited, only what little they need in the winter and early spring, before they can obtain it from abroad, which they will do very early in the spring, in preference to using the stock which they have on hand. It is very important that the Apiarian has a hive so constructed that he can remove the over surplus of bee-bread, or shift the combs when they become black as they usually do, after being in use two or three years and upwards. My hive is so constructed that the honey, bee-bread, bees or comb, can be equalized or divided, as the case may be, and which can be done at any time of year, as necessity might require.

Bees in their honey excursions do not confine their labors to the spot immediately contiguous to their dwelling, but when led by the scent of honey, will go a mile from it, and, if honey cannot be obained nearer, they will even go three miles to obtain it ; there are many instances on record where bees have gone much farther than that, but the nearer the pasturage, the more they will collect.

These insects, especially when laden and returning to their nest, fly in a direct line, which saves both time and labor. How they are enabled to do this with such certainty as to make for their own abode without deviation, I must leave for others to explain. Connected with this circumstance, and the acuteness of their smell, is the following curious account given in the Philosophical Transactions for 1721, of the method practiced in New England for discovering where wild bees live in the woods in order to get their honey. "The bee

hunter sets a plate containing honey or sugar upon the ground in a clear day, and the bees soon discover and attack it; having secured two or three that have filled themselves, the hunter lets one go, which, rising in the air, flies straight to the nest or tree; he then strikes off at right angles with its course a few hundred yards, and lets a second bee fly, observes its course by his pocket compass, and the point where the two lines intersect is where the nest is situated."

The most improved mode of bee hunting is simply this: Take a small box with a slide cover in the top, with a glass inserted, that the hunter may the more readily observe their movements; put a small quantity of honey in the box, (honey in the comb is preferable,) then search for a bee or several if convenient; as soon as they are confined in the box they will immediately fall to eating honey. The bee-hunter should have in readiness a small piece of chalk, from which he may scrape off a little and moisten it with spittle, and then by means of a straw, touch a bit of it to the back of the bee, and if more than one bee be marked, touch the second one twice and so on; it usually takes a bee about two minutes to load himself from a box. After marking him, open the box carefully and give him a chance to go to his nest; he will first make several revolutions before leaving, and when he does leave, his course will be straight to his abode.

It would be well for the bee-hunter to select as high a point of land as possible, as it is rather hard for the eye to follow a bee when in a hollow, or among shrubbery. Many times it would be advisable for the hunter to place himself upon his back so that he can the more easily detect his course, when he takes the "bee-line," as the hunters call it; when she returns she may fetch more with her, and a supply of honey should be kept in the box. The whole colony that this bee belongs to will come for the honey and by applying my Patent Bee Catcher in the right time, the whole swarm may be

secured. The particulars of this instrument will be given in the chapter on hives. In regard to timeing bees when they are lined to the woods, it has never been successful by either ancient or modern bee hunters, as so much depends upon the locality and conditions of the tree ; when the tree has a bad entrance, which many of them have, it will take a bee many times, ten times as long to deposit the honey after they arrive at the tree as it does to make the excursion into the fields after it. The same thing will hold good in regard to most of the bee hives now in use ; it will take much longer for the bees to enter the hive and deposit the honey than it does to go into the fields after it. In my Patent Hive there is a remedy for all these inconveniences. (See chapter on Hives.) The bee may have several feet to traverse after first entering the tree, and perhaps through a narrow crowded channel, before they can find a cell that is fitted for the deposit ; under these unfavorable circumstances, it is impossible to ascertain the distance of the tree from the box, by the time the bee is gone. Old bee hunters generally allow that a bee will require one and a half minutes to traverse a mile, and if loaded two minutes. when there is no wind to interfere. But when a colony runs away they are usually twice or three times that length of time flying a mile.

I would suggest to every young bee-keeper to spend a little time with some old experienced hand, before undertaking it alone. It is a well known fact with bee-keepers as well as bee hunters, that the honey bee as well as other species of insects, have a mode of conveying intelligence from one to another ; in fact it is a system of speech that is demonstrated in a variety of ways ; it is illustrated in the case of hunting the bees of the forest ; if they had no system of speech among themselves, they never would depart for the woods as they many times do, as in the case of swarming, nor would everything go on so systematically in the interior part of the

hive ; deprive them of their peculiar language, and they would be as much disorganized and confounded as the builders of the Tower of Babel were at the time God confounded their familiar language. It is acknowledged by all distinguished naturalists, that the different species of insects have a language peculiar to their species, and that they can just as readily understand each other as one man can understand another ; let a bee-keeper go to one of his hives and catch a bee and pinch him, and the cry of distress will be such as to cause many other bees to come to his rescue, and care must be taken on the part of the experimenter or he may get badly stung ; when a single bee finds a quantity of honey she can communicate it to the whole colony in a few moments of time, especially if the inmates of the hive are all present. Show one single bee a quantity of honey, and in a few hours time the attention of the whole colony will be turned towards it. The most appropriate time of day to commence to line bees, especially if the hunter wishes to capture the whole colony, is about three o'clock in the afternoon, if the weather be fine, and at night when the bees are all in, the news will be communicated to the whole swarm, and early on the following morning, if pleasant, the whole colony will be in hot pursuit for the honey that was discovered the day before by one single bee, and by ten o'clock the whole colony can be captured if desired, by introducing my newly invented bee catcher to the entrance of the hive, as that will admit of bees entering a hive or box, but they cannot return after they have once entered if the machine is properly set. Many scientific Apiarians allege that bees will scent honey some distance from the hive ; on a warm day this is true. "If a person wishes to call the bees to him rapidly," says an old bee-keeper, "burn a small bit of comb, and in a few moments there will be plenty of bees in the box."

Over Stocking a Country. There has much been said of

late on this point, although it has never been done in any part of the world as yet ; according to the accounts from the diff rent European Empires, Kingdoms and States, and according to our most celebrated naturalists and writers upon the honey bee, the Eastern Continent is far in advance of the Western, in the culture of the honey bee; history gives no account of its being any more fertile than this Continent but quite the reverse ; then why is it that honey is so-much more abundant there than here, when our facilites for rearing bees are far in advance of those of Europe ? When every plant, shrub and tree that we cultivate is beneficial to the bees, as well as the plants and shrubs that flourish spontaneously in our thousand fields, from one end of the country to the other ? and I think I may safely say nine-tenths of them are food for bees, either for honey, propolis or farina, or bee-bread. In many parts of Europe honey and bees-wax is one of the great staples for home consumption as well as exportation, as bee keeping is carried on in many parts of Germany, Scotland and Russia. We have numerous accounts of large Apiarys being almost in the same precinct or village, only a mile or two apart, numbering from 100 to 500 colonies each. In many parts of Hungary and Russia they frequently number from 1000 to 6000, yielding upon an average five dollars per swarm of spare honey, and by the use of the most inferior hives we have knowledge of; and should they give the colony a dose of brimstone as some very frequently do in the Fall, the yield and profit is much enhanced. We learn that it is not unfrequent for a traveler to find from 4000 to 5000 hives congregated at some of the principal points of heaths where the honey flowers are found in great abundance. At that season of the year when everything is favorable, they will fill their hives in a very few days ; they may be scattered somewhat so that it would take twenty or thirty minutes for a person to ride to them all. There are

bee-shepherds who take charge of them for a compensation of one or two shillings each ; when they are received by the shepherds they are marked and numbered, so that the different owners may at the end of the honey season, be sure to receive the hives belonging to them. With honey pasturage it is quite different from the pasturage we have for our cattle, sheep, &c ; although the honey pasturage many times abounds in our stock pastures, especially as far as white clovers and golden rod are concerned. The honey harvest differs as all bee-keepers are well aware in this respect ; at the proper season of the year appropriate for each plant, when the weather is warm and favorable, the honey producing plants yield their delicious nectar daily from one to three weeks, according to the kind of plants. Each plant has its own peculiar time for the shedding of its sweets, the same as our sugar maple, so that when everything is favorable as regards weather, the bees never experience any difference in collecting honey from a flower that, perhaps, has been visited before by other bees, a dozen times.

CHAPTER VII.

Honey Dews.

The term *Honey Dew* is applied to those sweet clammy drops that glitter on the foliage of many trees in hot weather. The name of this substance would seem to imply that it is a deposition from the atmosphere, and this has been the generally received opinion respecting it, particularly among the an-

cients. It is an opinion still prevalent with many naturalists that it falls from the Heavens. Virgil speaks, "*Aerii mellis coelestia dona.*" The Rev. Gilbert White, in his Naturalist's Library Calender, regards honey-dews as the effluvia of flowers, evaporated and drawn up into the atmosphere by the heat of the weather, and falling down again in the night with the dews that entangle them. But, if this were the case, the fall would be indiscriminate, and we should not have it confined to particular trees and shrubs, nor would it be found on green-house and other covered plants. Some naturalists have regarded honey-dew as an exudation, or secretion, from the surface of those leaves upon which it is found, produced by some atmospheric stroke, which has injured their health. Dr. Dorwin stands in this class. Others have viewed it as a kind of vegetable perspiration, which the trees emit for their relief, in sultry weather; its appearance being seldom observed in a cold summer. Dr. Evans is of this opinion, and makes the following comparative remarks: "As the glutinous sweat of the Negro enables him to bear the fervor of his native clime far better than the lymph-perspiring European, so the saccharine dews of the orange, and the fragrant gum of the *Cretan Cistus*, may preserve them amidst the heat, even of the Torrid Zone." Mr. Curtis tells us that the honey-dew is an excrementitious matter, voided by the aphis or vine fretter, an insect which he regards as the general cause of what are called blights. He assures us that he never, in a single instance, observed the honey-dew unattended with aphides.

His opinion is confirmed by the circumstance of its being generally found upon leaves which have others above them, the under side of which are inhabited by those insects. They may "be seen distinctly, with a small magnifier, on the leaves of the cherry, lime, hazel, &c., but invariably on the inferior surface, piercing the vessels, and expelling the honey-dew

from their posterior parts. They might easily have escaped the observation of the earlier philosophers, from being frequently concealed within the curls of the leaves that are punctured."

I believe it will be found that there are, at least, two sorts, or kinds, of honey-dew; the one a secretion, from the surface of the leaf, occasioned by one of the causes just alluded to, the other a deposition, from the body of the aphis. Sir J. E. Smith observes, of the sensible perspiration of plants, that when "watery, it can be considered only as a condensation of their insensible evaporation, perhaps from some sudden change in the atmosphere. Groves of poplar or willow exhibit this phenomenon, even in England, in hot, calm weather, when drops of clear water trickle from their leaves, like a slight shower of rain. Sometimes this secretion is of a saccharine nature, as De La Hire observed in orange trees." It is somewhat glutinous in the *tilia,* or lime tree, rather resinous in poplar, as well as in *Cistus Creticus.* Ovid has made an elegant use of the resinous exudations of the Lombardy poplars, which he supposes to be the tears of Phæton's sisters, who were transformed into those trees. Such exudations must be considered as effusions of the peculiar secretions.

"The loves of the ants and aphides have long been celebrated; and that there is a connection between th m, you may, at any time during the proper season, convince yourself; for you will always find the former very busy on those trees and plants on which the latter abound; and if you examine more closely, you will discover that the object of the ants, in thus attending upon the aphides, is to obtain the saccharine fluid secreted by them, which may well be denominated their milk. This fluid, which is scarcely inferior to honey in sweetness, issues in limpid drops from the abdomen of those insects, not only by the ordinary passage, but also by two setiform tubes

placed, one on each side, just above it. Their suckers being inserted in the tender bark, are, without intermission, employed in absorbing the sap, which, after it has passed through the system, they keep continually discharging by these organs. When no ants attend them, by a sudden jerk of the body, which takes place at regular intervals, they eject it to a distance." Mr. Knight once observed a shower of honey-dew descending in innumerable small globules, near one of his oak trees, on the first of September. The power which these insects possess of ejecting the fluid from their bodies seems to have been wisely instituted to preserve cleanliness in each individual fly, and indeed for the preservation of the whole family; for, pressing as they do upon one another, they would otherwise soon be glued together, and rendered incapable of stirring. When the ants are at hand, watching the moment at which the aphides emit their fluid, they suck it down immediately; this, however, is the least of their talents; for they absolutely possess the art of making the aphides yield it at their pleasure, or, in other words, milking them, at their pleasure. The ant ascends the tree, says Linæus, that it may milk the cows, not kill them. Huber informs us that the liquor is voluntarily given out when solicited by the ant, the latter tapping the aphis gently, but repeatedly, with its antennæ, and using the same motion as when caressing its own young. He thinks, when the ants are not at hand to receive it, that the aphis retains the liquor for a longer time, and yields it freely, and apparently without sustaining the least detriment; for, even after acquiring wings, it shows no disposition to escape. A single aphis supplies many ants with a plentiful meal. The ants occasionally form an establishment for their aphides, constructing a building in a secure place, at a distance from their own city, to which, after fortifying it, they transport those insects and confine them under a guard, like cows upon a dairy farm, to supply the wants of

the metropolis. The aphides are provided with a hollow, pointed proboscis, folded under the breast when the insect is not feeding, with which instrument they puncture the turgid vessels of the leaf, stock or bark, and suck, with great avidity, their contents, which are expelled nearly unchanged; so that, however fabulous it may appear, they may literally be said to void a liquid sugar. On looking steadfastly at a group of these insects, (*Aphides Salicis*) while feeding on the bark of the willow, their superior size enables us to perceive some of them elevating their bodies and emitting a transparent substance, in the form of a small shower.

> "Nor scorn ye now, fond elves, the foliage sear,
> When the light aphides, arm'd with puny spear,
> Probe each emulgent vein till bright below,
> Like falling stars, clear drops of nectar glow."

The willow accommodates the bees in a kind of threefold succession; from the flowers they obtain both honey and farina, from the bark, propolis, and the leaves frequently afford them a plenty of honey-dew, and at a season when other resources are beginning to fail.

Honey-dew usually appears upon the leaves as a viscid, transparent substance, as sweet as honey itself, sometimes in the form of globules, at others resembling a syrup. It is generally the most abundant from the middle of June to the middle of July, and sometimes as late as September. It is found chiefly upon the oak, the elm, the maple, the sycamore, the lynden, or basswood, the lime, the willow, the hazel, the blackberry, and occasionally upon currant, cherry and other fruit trees—sometimes upon only one species of trees at a time. The oak generally affords the largest quantity. At the season of its greatest abundance, the happy humming of the bees may be heard at a considerable distance from the trees, sometimes nearly equalling, in loudness, the united hum of swarming.

Honey dews usually occur pretty extensively every three

or four years, but to some extent, in most localities, every year. The honey-dew was noticed by the ancients, and is mentioned by Pliny by the fanciful designation of "the sweat of the heavens and the saliva of the stars," though he questioned whether it is not a deposition from the air, purging it from some contracted impurity. More modern philosophers have been quite as erroneous and discordant in their opinions in relation to its nature. Some, with the most unmitigated asperity, declare it is the excrement of aphides; others as exclusively maintain that it is an atmospheric deposit; and a third party considers that it arises from bleeding consequent upon the wounding of some insects. That there may be a glutinous saccharine fluid found upon the leaves of plants, arising from the first and third named causes, is probable, or rather, certain; but this is by no means conclusive that there is not a similar liquid, extravasated upon the surface of the leaves, owing to some unhealthy action of their vessels. After noticing the theories of many ancient and modern naturalists and apiarians, there is no question but what the honey-dews are caused by those small insects called aphides.

There are, it is true, many species of dews, and some of them are called honey-dews, but arising from the above named causes; consequently they differ widely from the dew caused by the aphides.

CHAPTER VIII.

Bees Wax.

Wax is a vegetable product, deriving its origin from the saccharine principles existing abundantly in the products of nature. It is found upon the upper surface of the leaves of many trees, in the form of varnish, and possessing all the qualities of bees-wax. The wax bearing myrtle, *(Myrica Cerifera,)* a shrub which grows abundantly in Louisiana and other parts of the United States, and there is also in many parts of the East and West India islands, shrubs that produce wax in great abundance. The myrtle bears a small berry, of which wax forms its outer coating, and when exposed to a flame, burns with an agreeable aromatic odor. Doct. Darwin supposes that the design of the waxen varnish which covers the flowers, is "to glaze over the fecundating dust of the anthers, and prevent its premature explosion from excess of moisture," and ascribes to an unreasonable diffusion of anther dust, the failure of orchards and corn crops, in summers of extreme humidity.

The quantity of wax found in this form is small, compared with that which is produced by the honey bee, and also of inferior quality. When pure it is of a whiteish color and destitute of taste, with scarcely any smell; it grows brown and even black with age. After manipulation it has an arromatic smell, which, however, disappears on exposure to the atmosphere. The dust of flowers, called pollen or farina, was long supposed to be the element of wax, and it is a curious instance of the tardy progress of the knowledge of Natural History, that though the mode in which wax is produced by

the bees, was ascertained beyond all doubt by Huber, over forty years ago, there is yet little known and scarcely believed, and farina has with many, still the credit of being what is called "crude wax." Buffon was of this opinion, and, in an edition of his work published as late as 1821, no notice is taken of the recent discoveries on the subject, which prove his opinions to be erroneous. Reaumur was inclined to believe that pollen, by receiving some peculiar elaboration from the bees, was converted in the stomach to real wax, and disgorged under the appearance of paste. Later observers, however, denied that wax was disgorged by the mouth ; they affirmed that it exuded from the rings of the abdomen, in the form of small scales, and that pollen was used for very different purposes. That this last mentioned substance is not the prime constituent of wax, was a conclusion drawn by repeated and accurate observations by our most celebrated Apiarians. It has been observed, for instance, that pollen is carried into the hives in great abundance, that were already filled with comb ; that it is often of various colors, while new combs are always of a pure white ; that new swarms for a few days carry in no pollen, although their first work to be done after being hived, is the building of new combs, which progresses with unremitting rapidity, and that while it has been ascertained that 100 pounds of pollen has been carried into a hive during one season, the whole weight of the comb in the hive when separated from the honey and farina, weighs something less than two pounds.

Huber lodged a young swarm in a straw hive, furnished them with honey and water, and after five days confinement he perceived that they had consumed the whole of their provisions, and had constructed several combs of beautiful wax. These combs were removed and more honey given them, and and the result was the same. This removal was made five times successively, and on each occasion, being supplied ex-

clusively with honey, they produced new combs ; thus putting it beyond dispute, that this substance effected the secretion of wax in the body of the bee. And farther, to ascertain whether the saccharine principle were the real source of wax, he supplied the captive bees with sugar in the form of syrup, and the result was still the same ; wax was produced, and that in a shorter period and in greater abundance than from honey ; as the reverse of this experiment would prove whether pollen had the same property, instead of supplying the bees with honey or sugar, he fed them only on fruit and farina. They were kept captives eight days under a glass bell, with a comb having only farina in the cells, yet they neither made wax nor were there any scales of wax on their abdomen, as was the case when honey and sugar were used.

It is but justice to the Scotch Bee Master, Bonner, to remark, that, amidst the errors that prevailed on this subject during his day, he had a strong impression of the real source of wax, and the manner of its secretion. In this, as in other parts of bee science, his natural acuteness and shrewdness of observation, led him to the very verge of some of the most important of those facts in the natural history of bees, which we owe to the more scientific researches of Huber.

" I have sometimes," says he, " been inclined to think that wax might be an excrescent exudation, or production from the abdomen of the bee, and that the Queen can lay eggs when she pleases, so, if required, the worker bees can produce wax from the substance of their own bodies. If this conjecture be right, it will follow of course, that all the food which a bee takes, contributes to the formation of wax in the same manner as all the food a cow eats, contributes to the nourishment of her body, and the production of milk ; (bees consume much more honey or sugar when wax is required,) or, to adopt a nearer simile from the insect tribe, as all the food a spider takes, contributes not only to the nourishment

of the animal, but to the production of the substance of the cob-web from its body. Numberless other analogies in nature might be cited in proof of the probability of this theory. The silk for instance, produced from the body of the silk-worm, is a substance as different from that of the animal itself, or of the mulberry leaf it feeds upon, as wax is from that of the body of the bee, or of the honey or flower she sucks. And the excresence produced in the human ear, which goes by the name of wax, is certainly as different from the substance of the body which produces it, as either the one or the other. Upon the whole, until I meet with a more probable theory supported by facts, I must give it as my humble opinion, that the wax is produced only one way, and in all cases upon the abdomen of the bee, in very small minute scales, and that wax cannot be produced unless the bee feeds upon honey or sugar, or what honey and sugar is produced from, and that bees do not produce wax continually, but only at such times as comb is needed in the storing up of honey, and at such times bees consume a much greater amount of food than when there is no need of comb.*

I here give the Analysis of Bees Wax, as given by Dr. Bevan:

Carbon, - - - - - - - - -81,79,
Oxygen, - - - - - - - - 5,54,
Hydrogen, - - - - - - 12,67.

The formation of resin or wax, has been explained thus: That when a volatile or fixed oil is expelled out of plants, and has its surface exposed to the air, the first becomes a resin by loosing hydrogen, the second a wax, by absorbing oxygen.†

To Wax Purchasers. I will give a few useful hints of the way to tell good wax. Draw your thumb nail over it care-

*See Bonner on Bees, page 195.

†Parker's Chemical Catechism, page 244, 11th edition.

fully, and if it goes over it roughly and sticks upon the nail, it is a sign of good wax ; but if the nail passes over it smoothly, it is a certain proof it has been adulterated with suet or other greasy substances, which is very often done to swindle the public and more especially peddlers.

Directions for Extracting Wax from Combs. Put the comb to be reduced to wax into a bag made of strainer cloth, not filling the bag very full, and then immerse it in a kettle or boiler of hot water ; sink it in the water two or three inches below the surface, turn it over occasionally when boiling, and the wax will all boil out in 30 or 40 minutes, if you keep up a brisk heat, and be ready to strain, although most of the wax will rise on the top, if the bag is turned over constantly, in less time than it may be strained by squeezing in the usual way ; most of the wax will be extracted before that time, and it can be poured off into a vessel to cool. If the wax is to be white, pour it or sprinkle it on to a board or smooth surface while hot, so it will appear in thin scales, then expose to the rays of the sun for a few days, and by so doing it will become perfectly white. Another way is by melting it occasionally, and it will become almost perfectly white in a short time, then cake to suit the fancy. Many times the comb may contain young brood, but in boiling, the wax will all arise on top, and the residue after squeezing, is of course, good for nothing, as it contains cocoons, bee-bread, and young bees, many times. Old comb does not produce the amount of wax that new comb does, according to the weight. A common box hive will usually produce from one to two pounds of wax, if all the comb is worked into wax.

Bees Wax forms a considerable article of commerce, and large quantities of it are annually imported into this country from South America, Mexico and Cuba. According to statistics, Mexico has imported some seasons over a hundred [illegible] that Cuba exports annually.

to New Spain, near a hundred thousand dollars worth of it, besides the other large amounts that she exports to other countries. According to Buffon, the wax in southern latitudes is not as good in quality, as that raised in cool climates. Canada produces an immense amount of wax annually; Russia also exports it in great abundance.

CHAPTER IX.

FARINA, OR POLLEN.

Farina, or pollen, is the fertilizing dust of flowers, and forms a very important ingredient in the nourishment of the young bees. Before the discovery of the true origin of wax, it was supposed to constitute the rude material of that substance, being taken into the stomach and converted, by some peculiar action of that organ, into real wax; and hence, among French naturalists, it had obtained the name of crude wax. The bees eagerly set about collecting this nutricious substance as soon as the season affords it, and continue to do so throughout the season, not only for immediate use, but also for storing up against the season when it cannot be obtained abroad. There are many species of plants, trees and shrubs that afford bee-bread in great abundance. Bees are often seen carrying in pollen very early in the Spring, long before vegetation starts. In such cases it is obtained from willow, balm gilead, basswood, maple, and several other species of trees, according to the the portion, or section, of country that it is in. It is always to be observed that the

farina carried in early Spring, is of a greenish color.—There is scarcely a flower that grows that does not yield pollen, to a greater or less extent. The pumpkin, squash and sun flower yield it in great abundance. It has always been observed that bees collect pollen from only one species of flower upon the same excursion, as the little pellets upon their hind legs are always of one color. At the season of the year when the flowers produce honey, the bee not only collects a quantity of farina, but also a load of honey. So great a desire have the bees for storing up farina, that many times they nearly fill their hives with this substance. This is the case with older swarms. Many times, on examining a hive three or four years old, nearly one-half the weight of the hive consisted of bee-bread. But this is not the case with young swarms, as they frequently suffer for the want of it, the ensuing winter; and, many times, the colony is lost for the want of bee-bread, as they cannot rear their young without it, and hence the great necessity of having a hive in which you can equalize the bee-bread, as well as the honey, among the different colonies. After the hive has been occupied one year, it generally has a surplus of bread, nd, like honey, it grows worse after the first year, and accumulates in large quantities. The bees seem to take a dislike to it, after it has been stored up for one season, and this accounts, in a great measure, for the fact that bees, in early Spring, are seen to carry in fresh bee-bread, as they prefer it much to the old stock that they may have on hand. When a hive contains a surplus of farina, it is a great damage to the bees, as such cells are neither fit to store honey, nor to brood in. When there is an over stock of bee-bread and black comb, the bees should be removed from the hive, or the comb removed every two or three years. (See chapter on the Removal of Bees.)

I would here remark, for the benefit of those who entertain the erroneous impression that the honey-bee carries the wax to the hive on the baskets of his hindermost legs, that they never carry wax in that manner, but farina, or bee-bread, and when they have a use for propolis they carry that on their legs also, and these are the only substances ever seen upon the legs of bees. (For particulars on Propolis see Chapter X.)

The collection of pollen by the bees is made, in the greatest quantity, in the earlier part of the day, before the heat of the sun has dried up the moisture which renders it more easily packed into the little masses which adhere to their legs. After they are fully loaded, they return to their hive and deposit their burden in cells in which there is neither honey nor brood. The manner in which a bee unloads itself has been already noticed.

A Substitute for Bee-Bread. Take common rye meal, or buckwheat flower, place it where the bees can have access to it, and in another vessel place some water. If bees can be favored this way in the months of February and March, it will greatly advance early swarming. (See chapter on Feeding.)

CHAPTER X.

Propolis, or Bee-Glue.

Propolis is a tenacious substance, generally of a dull grey color, gathered by the bees from the buds of certain trees, in early Spring; especially from the alder, the birch, the poplar, and the willow. It is of great use to the insect, in various ways. The ancients supposed it to consist of three different substances, or rather, perhaps, of three modifications of the same substance, according to the different proportions of wax blended with it. Huber, to ascertain the fact of its origin, stuck some branches of the wild poplar in pots of earth, in front of his apiary. The bees immediately discovered them, and set about loading themselves with the identical substance which he had often detected adhering to their hives, in the same manner as farina. He observed them "separating the folds of the buds with their teeth, drawing out threads of the viscous substance, and lodging a pellet of it in one of the baskets of their limbs." He ascertained farther that branches newly cut did not seem to attract the insect; the viscous matter in them had less consistency, and therefore did not suit their purpose. The branches he used had been cut some time. This last circumstance seems somewhat unaccountable. It can be but seldom, generally speaking, that the bees have it in their power to gather propolis from cut branches; in point of fact, at a time when they most need that material, we see them busied, in hundreds, on the growing trees, and bringing it home in large quantities. The bees also resort to the different gum and balsamic trees, such as the spruce, pine, balsam, hackmatac, &c. In many portions of the Northern States, the bees make a great use of

spruce gum in filling up cracks and crevices; sometimes they blend a little wax with it, and, at others, they use it in its pure state. Sometimes they resort to the hollyhock, as it is somewhat of a gummy plant. The bees employ this substance in the commencement of the structure of their comb, to attach it more firmly to the foundation than could be effected by wax alone, which is neither so tenacious nor attains to so great a degree of hardness. Indeed, it possesses the former of these qualities to such a degree that the bees find some difficulty in detaching the pellets from the baskets on their legs, and have been observed availing themselves of the aid of their companions, for that purpose. And hence, aware of its tenacity, they are observed gathering it only in the heat of the day, when it is rendered more ductile by the warmth. It is employed to attach the edges of the comb to the sides of the hive, where it forms a projection from the comb and serves the purpose of a *point d'appui*. Every bee-master is familiar with the use made of it, in fastening the hives to the bottom board. It is especially employed as an effective barrier against the intrusion of enemies. The bees have been observed contracting, by means of propolis, the entrances of their hives, and erecting something resembling barricades with it, when they have reason to fear the death-headed *hawk-moth*, though the latter is but little known in this country. The name *propolis*,* given to this substance by the ancients, prove that the use the bees make of this resinous exudation in fortifying their dwellings, has long been known. We have one or two amusing instances recorded of a farther use which their instinct has taught them to make of this substance. A shell-snail had found its way into one of Reaumur's hives, and fastened itself, by means of its slime, to the glass. The bees, unable to remove it, fell upon a method,

*Propolis, compounded of the Greek words *pro* and *polis*, signifying "before the City."

and at a small expense of labor and material, of preventing any annoyance from the intruder. They formed a body of propolis around the edges of the shell, where it rested on the glass, and thus fixed it immovably. A slug-snail had crawled into a hive of Moraldi's, and was disposed of in a similar manner, though with more violence. The bees immediately surrounded it and stung it to death. The disposal of the dead body was the next consideration. It was too bulky to be removed by their puny efforts, but they covered it over with propolis, thus completely preventing the injurious effects that might have arisen from putrefaction.

CHAPTER XI.

Drone, or Male Bee.

The drone, or male bee is the only perfect male in the hive, and the only office assigned them by naturalists is to pair with the young Queens. They make their appearance about the end of April, or first of May, and are seldom seen after the month of August, except under very peculiar circumstances. When a colony has lost their Queen, then the drones are killed by violence, but otherwise they would live, probably, to nearly one year before they would die with old age. They are much larger than the worker bee, nearly twice as thick, and of a dark color. Many of them have a white or yellow ring encircling the body. They have shorter jaws, as well as shorter proboscises, and are more blunt at the [illegible] than either the Queens or workers. The last ring

of the body is fringed with hair, extending over the tail, and visible to the naked eye. They make a loud noise in flying, and are destitute of baskets on their thighs. They have no sting and are rather shorter than the Queen, but otherwise much larger. Underneath their tail, two small protuberances, of a yellowish color, may be seen, which are regarded as distinctive marks of their sex. In some hives, drones hatch much more abundantly than in others, owing to the larger amount of drone comb, as the more drone comb the hive contains, the more drones will be hatched from that hive. Many times the drones in a hive will constitute nearly one-third of the whole population, and, sometimes, much more than that, and at other times there will be scarcely any at all; but nine-tenths of bees generally, in common hives, are overrun with these worthless consumers. Too many drones are much worse than none at all. If a bee-keeper has several swarms of bees on hand, one hive would be sufficient for the rearing of drones, and, even then, one hundred would be better than one thousand, and if there were neighboring apiaries, within a mile or two, it would be still better if there were no drones, at all, raised, as the Queen never pairs with but one drone during her whole life. Let the bee-keeper ever bear in mind that when drones are discovered in a hive in the last of September and first of October, or later, there is no Queen in that hive. This is invariably the case. There are, also, other signs about a hive showing the loss of the Queen, which will be mentioned in another chapter. For further description of drones, see chapter on Anatomy and Senses of Bees.

CHAPTER XII.

Feeding Bees.

This is a business which is in general, very injudiciously managed by all classes of bee keepers ; we have found it necessary in very many cases to feed bees, but it should always be managed with care and caution. I am aware much has been said upon the subject of feeding bees. It is not advisable to feed bees in the way that many do, by placing the food in an open trough, in front of the bee house, as it will many times set the bees to robbing, and should be avoided.

Circumstances under which Bees need Feeding. If the bee-keeper has a late swarm that will not winter without feeding, or if he has a swarm that is nearly wintered through, to such, many times, feeding may be necessary to carry them safely into the honey season ; in order to feed bees safely and profitably, it is very necessary that the Apiarian has a proper kind of hive ; there are several patent hives better adapted to feeding bees than for their management in general. My newly invented patent hive has many advantages over common hives in the way of feeding, putting several swarms together, as is necessary to do many times, of dividing a swarm and making two of it, &c. My hive is as well, if not better adapted for the feeding of bees than any hive now in use ; bees should always be fed from the top of the hive, for the top of the hive if properly constructed is nearly as warm as the interior amongst the bees ; the way and manner my hive is constructed is well adapted for feeding at any season of the year, as there is a dead air space the whole size of the hive, seven inches in height ; it can be made perfectly tight or ventilated if desired.

The Proper Time for Feeding Bees, is in the month of October ; then the Apiarian should examine his bees, and such as need feeding should be fed, and if possible, fed enough to last through the winter ; if the feed is in the form of honey in the comb, the bee-keeper should take a fork and scratch the caps of the honey cells, and the bees will extract the honey therefrom and carry it below and deposit it in the combs ; after the honey has been placed in the air-chamber, when the top of the hive is raised up to admit the feed, care should be taken in shutting it down, so as not to injure any of the bees ; if the food is in the form of liquid honey or sugar syrup, then it should be placed in a dish or pan, over which place some loose straws cut to the length of the dish to keep the bees from getting drabbled in the contents, as the straws will float upon the surface of the liquid, and remain in the bottom of the dish after the feed is taken up. If the colony is a suitable one for wintering, it will take up two or three quarts in twenty-four hours time. The bee-keeper should never attempt to winter a small swarm, especially if they are to remain out of doors. For particulars in wintering and doubling swarms, see another chapter. The custom of feeding bees at the bottom of the hive, as many bee-keepers do, is generally attended with much trouble, and sometimes great loss of bees ; when bees are fed from the bottom of the hive, if in warm weather as it should be for the bees to come down from the combs above, it is very apt to attract the attention of neighboring colonies. At the season of the year when there is no honey to gather from the fields, there is nothing that will induce bees to robing sooner than feeding from the bottom of the hive ; but my system of management overcomes everything of this kind, the food being put into the top of the hive, and shut up tight, then of course no other hive knows anything about it ; in this way bees can be fed safely whenever you have occasion to feed them. The bee-master should be particular in removing the slats from the honey board, so that the bees can have free ingress and egress from the hive below.

Bees never should be fed in the honey season, when there is a plenty of honey in the fields, for by so doing it often creates in bees, thievish, indolent habits. If the bee-keeper wishes to feed his bees in cold weather, he must put them into a warm room where there is a fire, and keep them there until they have carried all their feed down and deposited it in the combs below ; it is bad policy for Apiarians to be continually feeding their bees, but when bees are fed they should have a full supply. enough to carry them into the coming honey season. Bees eat much less honey when deposited in their hives where they can help themselves ; feeding them often keeps them so much agitated that they will require four times the honey that they otherwise would. In order to prepare food for bees, if it is southern honey that is to be fed, it should be placed over the fire and brought to a boiling point, and then allowed to cool. This boiling process evaporates all the poisonous qualities the honey might contain, as much of the southern honey is gathered from poisonous flowers. See chapter on honey pasturage. If sugar is to be fed, it should first be reduced to a syrup, and when cold add the white of an egg to every ten pounds of the syrup, then place it over the fire and fetch it up to the boiling point, and skim it as fast as the scum rises. The syrup should be of the consistency of common molasses when cold ; if it is thinner than that, the watery part of it will have to evaporate before the bees can seal it over. I have known many bee-keepers in my experience, to buy southern honey and sugar and feed their bees with it, so that they might realize a large amount of surplus honey for market; sometimes when sugar is low, and box honey high, it will pay very well, providing the bee-keeper has a plenty of spare honey comb to insert into his boxes ; but if he compels his bees to make the comb, he will find it an up hill business. I trust my readers will bear in mind that such honey as this is not like the honey made from the fields and gardens of the New England States ; some people imagine they can give their bees brown su-

gar, and the result would be No. 1 honey, like that made from the white clover ; but we would inform such bee-keepers, that the sugar does not undergo any chemical change by the bees taking it from the feeding trough and depositing it in the hive, but is sugar still, although it may pass for honey when all sealed up in the comb, with those that are not familiar with the different qualities of honey ; although bees will winter upon this food as well as upon white clover honey, if they have it deposited in the hive in the fall. Plain sugar candy is an excellent substitute for honey ; it should be reduced to a syrup, although some bee-keepers give it to the bees in the stick.

The bee-keeper should furnish all his bees on the first of March with rye meal or buckwheat flour ; if this kind of food is not handy, wheat flour will answer ; they should also have water and salt, and the water should be covered with straws as in honey feeding, to prevent the bees from drowning, and the salt should be moistened with a few drops of water ; all these assist greatly in bringing forward an early swarm, and also in contributing largely to the health of the swarm in general. The flour when kneaded into bread by the bees, answers every purpose of farina, and in fact, they much prefer it to the old bread they may have in the hive. Bee-bread and water are the first articles bees go in pursuit of in early spring, and many times necessity drives them from the hive so early in the spring, that hundreds are lost by getting chilled with the cold ; hence the importance of supplying the bees with those necessaries, so that they may swarm early and throw off powerful swarms ; in the use of my hive all these things can be accomplished a month earlier in the season, especially if the hive is kept in-doors.

CHAPTER XIII.

Swarming of Bees.

The swarming of bees is a sight that bee-keepers delight to see. Much, I am aware, has been said upon the subject of swarming, both *pro* and *con ;* as bees increase in number, instinct appears to have taught them that when their hive became full a portion of them must emigrate and seek a new home ; bees generally swarm for the want of room ; should the bee-keeper increase his hive in size as the bees increase in numbers, it is not often that they will attempt to swarm ; when a swarm is thrown off the parent hive is usually full of comb filled with honey, bee-bread, and young brood ; if it is an old hive, much of the comb will contain bee-bread, whilst a smaller portion will contain the brood, and it very frequently happens that there is but little honey at the time of the first swarm being thrown off.

The more rapidly bees breed, the more rapidly do they consume honey ; it is very seldom that bees can lay up any surplus honey until the white clover appears, although they may have had access to the different species of flowers for weeks; perhaps apple tree blossoms, raspberry blossoms, dandelions, &c. There are many symptoms or signs, says a modern bee-keeper, to lead the Apiarian to suppose that his bees are about to swarm. When bees hang upon the outside of the hive in large numbers, as they very frequently do, it is a sign they anticipate swarming soon, but more properly speaking, it is a sign they want more room in the interior of the hive. There are thousands of bee-keepers who have kept bees for many years, and yet are not aware of the cause why bees do not swarm regularly. There is always more or less trouble with bees every year in regard to swarming, and but few bee-keepers as yet have learned the true cause.

This season seems to have been worse for bees in this respect, than any previous season for many years. This year, 1858, up to August 1st, there is not a colony in twenty that has swarmed at all, and the great inquiry among the Apiarians is, what is the cause of it? I will endeavor to give the caus according to the best information I have obtained from the most celebrated Apiarians, with my own researches upon the subject combined. This present season I have dissected and removed from the common hive to my patent hive, near a hundred swarms; many of them I have found in a deplorable condition, and many of them nearly destroyed by the millers, and others nearly out of honey, while many more were destitute of Queens and young brood; by providing them with a Queen, when convenient to do so, or adding them to another colony that had a fertile queen, I have been enabled to save them all. I will here mention some of the principal causes why bees have not swarmed: In the first place, the year 1857 was a very unfavorable year for bees in the New England States; there were but few bees that secured honey enough to carry them through the winter, then we had quite as bad a winter for bees as the previous summer, being quite an open one with much warm weather, that would naturally induce bees from the hive, and when bees once leave the hive in winter, they seldom if ever return; after bees become chilled they alight upon the first object in their way, and there perish; and again, with many swarms that were over two years old, the interior part of the hives were in such bad condition that it was impossible for a colony to breed fast enough, considering the small mount of room in the interior part of the hive that they had for the conveniences of breeding. In many hives after they have been occupied three years and over, the comb becomes so black and dirty, that the bees will neither brood nor store honey in it, and many times half of the cells and sometimes more, will be filled with bee-bread, so there is but precious little room for the bees to store honey and brood in. It

being such a mild winter it induced many colonies to commence breeding early, and before the brood was fully developed, weeks of cold and wet weather followed, till the stock of honey was exhausted, and the workers were not then able to collect enough to meet the demands of the brood; these in many instances perished, and in others were greatly retarded in their metamorphosis and development. As a consequence, many of the young Queens were destroyed in at least two of every three colonies; this was more generally the case in the Western States than in the New England States.

The only remedy I could suggest, would be to have them shifted from the old hive to one of my patent hives, as then the bee-keeper can remedy all these troubles that his hives may be subject to. While bees occupy the old style of board and straw hives, (and it is the case with nine-tenths of the patent hives now in use,) it is utterly impossible for the Apiarian to ascertain the true cause, when his bees do not prosper and do well. It is always best to let bees swarm if they will, to a certain extent; in northern latitudes bees never should be allowed to swarm more than twice, and seldom but once; if favored by the right kind of season and a proper kind of hive, bees might be allowed to swarm twice profitably, all after swarms generally speaking, are a damage to the parent hive and should be prevented.

Remedy to Prevent Swarming. To those bee-keepers using my patent hive: After the first swarm has departed, open the hive and examine all the combs, which can be done by taking out a card of comb and looking at both sides of it for the queen; look the cards all through if she is not found before, and if she is not found upon the comb, then the bee-keeper may rest assured that she is not yet hatched; then examine for the sealed Queen's cells and cut out all but one and it will stop the swarming of that colony for that year; if it is in the early part of the year, the bee-keeper may have to examine his hives occasionally for a few weeks, and see that there are no more Queens raised;

in this way swarming will be overcome, as bees cannot swarm unless there is a Queen to accompany them, this is the cause many times why bees return to the parent hive after attempting to swarm ; the Queen was not with them, if she had been they never would have returned to the parent hive again. There are various ways in which bees can be prevented from swarming ; some of the ancient Apiarians resorted to the clipping of one of the wings of the Queen, and thus preventing her from leaving the hive, but according to my experience, the better way is to give them plenty of hive room and whenever they manifest a disposition to swarm, prevent the hatching of Queens, and no swarming will take place.

Artificial Swarming, or Dividing of Swarms. This can be brought about whenever it is desired, but should be done in the swarming season. Suppose the bee-keeper has a large colony of bees ; if he wishes to make two swarms of them he can do so by following the directions here mentioned. If the Apiarian wishes to divide a swarm into two or more colonies, great care should be taken in putting the younger brood or eggs equally in the different hives, so that the bees will have the means of rearing other Queens in case it is desired ; as the old hive contained but one hatched Queen, consequently one of the new colonies, (in case two swarms are to be made from one,) will be without a Queen, and of course will have to rear them one, which they will readily do if they have worker eggs or larvæ that are not overthree days old. It can be ascertained in a few hours time which hive contains the old Queen, as in the other hives they will immediately commence several royal cells. Then one of the hives should be placed upon the platform where the old hive stood, and the other one will have to be shut up for three or four days and supplied with water and honey should they need it, and then they can be let out safely; otherwise they would go back to the old familiar spot where the old hive stood. When a person is so situated that he can attend to his

bees as he should, it is preferable to let them swarm naturally, although he may have the trouble of hiving them three or four times, and then perhaps they will leave him for the woods, unless the bee-keeper possesses one of my patent regulators or Drone Killers; by the use of that instrument, when properly adjusted, the Queen cannot leave the hive, and the consequence is, the bees have to stay wherever they are put if the Queen is with them. See description of this instrument in chapter on hives.

Bee Protectors. We have Bee Protectors that we can furnish to such bee-keepers as are naturally afraid of bees; they are manufactured from a species of linen net-work that is perfectly bee-proof. The Apiarian should first put on a hat, as this protector is made to go over the crown of the hat and draw up with a gathering-string; the part coming over the rim of the hat should be tucked under the collar of the coat or vest; when the wearer has this armor on he would hardly know it, from the fact of its being so open and light. If a bee-keeper wishes to try many experiments with his bees, the protector is a very important thing to have, as bees when disturbed, are more apt to seek the face than any other part of the body. The price of these protectors sent by mail, will be 36 cents, or 12 postage stamps; if delivered in Burlington, 25 cents. Ladies can make use of them as well as gentlemen, by wearing a hat.

CHAPTER XIV.

Transfer of Bees.

Directions for removing Bee-Comb and Honey from any kind of hive to Kidder's Patent Compound Hive. When a swarm is to be removed or changed, the operator takes a pail of cold water and sprinkles the hive thoroughly, especially if it is in warm weather, when the bees are out; then tip the hive up an inch or two in front, so as to expose the bottom board; then sprinkle it again. The cold water has a very subduing effect, and drives the bees up amongst the combs. Then carefully take up the hive that is to be removed, and carry it a few feet from the old stand, so as not to attract bees from other hives; after taking the hive to be removed from the stand, have a box in readiness holding from two to three pecks; have the size, if possible, near the size of the hive that is to be changed; if it should be too large, set the hive upon it cornering. A sheet is tied around the two, where they meet, in order to prevent the bees escaping, which, if folded lengthwise, will stop up all crevices. The box should be placed bottom downward, under which place a rope fifteen or twenty feet in length; set the hive upon the box carefully, then wind the sheet around quickly, and fetch the rope over the top of the hive by means of a slip-noose in one end, and make it fast; then wind the balance of the rope around the sheet, so as to shut them all in, and then carry them a few rods from the bee house, or stand. Turn the hive carefully bottom upwards, so as bring the empty-box on the top; then commence drumming them with a couple of sticks four times as large as common drum-sticks; drum them briskly for twenty or thirty minutes, until they cluster in the top box, which they will do as soon as they gorge themselves with honey.

They will nearly all cluster in the box, and as soon as the Queen joins them they will become quiet and still. When they are first agitated they set up a loud humming noise, thinking they are to be robbed. They fill themselves with honey as rapidly at possible. After they have been sufficiently drummed, the rope and sheet can be taken from the hive, and the box containing the bees can be set one side, upon some sticks so that they will have a plenty of air. As soon as the hive is taken from the stand, there should be another empty hive or box placed upon the same spot so that the bees that may be in the field will have a temporary home until the new hive can be returned, otherwise many of them might enter other hives, should they stand near by; and when the new hive is ready to set upon the stand, this decoy hive should be removed. Set it, bottom upwards, in front of the bee house, and all the scattering bees will find their way into the new hive in a few minutes. Care should be taken, when the new hive is placed upon the stand, to have it stand just where the old one stood, and whenever it is moved, especially in the honey season, it must be moved only a a few inches at a time, unless it is to be removed a mile or two. Now to the hive that has been drummed: after the sheet is taken from the hive, spread it upon the ground, or floor, as the case may be, and place the new hive in the centre of it; take the top off, and also the honey-boards and boxes, should they be on; take the comb guides out and place them near the table or bench where the transfer is to be made. If possible, place a board under the hive as it stands upon the sheet, and then raise it from the board by putting under it four little blocks one-fourth of an inch high, so that the bees can enter more readily, when shaken down in front of the hive. Returning again to the hive that is to be transferred, take a saw, or large knife, and loosen the comb from the sides of the hive that is to be removed; then, with the assistance of an axe, split or pry off one side, and if convenient, two sides, that the comb and honey may the more easily come

out; take out one piece of comb at a time, if it is suitable to put in a frame. Lay it upon the table, and lay the comb guide upon it, and, with a sharp knife, cut to the size of the guide. Have it come in the guide, after it is cut to the right size, the same side up that it was originally in the old hive. Fasten it in by means of a cotton twine, wrap it around the guide, both ways, and tie it fast, and so continue to do, until the whole is removed from the old hive. Should there not be enough to fill the hive, insert empty frames. When the transfer is made at the commencement of the honey season, six or eight pounds of honey will be sufficient to give them; but when made later in the season, then, of course, they will need more honey It will be necessary to give them all there is, and what cannot be put into the guides should be placed in a dish in the top of the hive. (See chapter on Feeding.) The hives should be ventilated and kept in a warm room for three days, so as to give the bees a chance to repair their combs, pack away the honey, &c., especially if it is cold, chilly weather. Shut them in the hive while in the house, and also when placed upon the stand. In warmer weather, but twenty-four hours would be sufficient to repair their combs. The reason why the hive should be closed for a day is to prevent robbing, until they get organized again. But the hive must be well ventilated when they are shut in. If in the honey season, the bees may have the full entrance after twenty-four hours; but if it is out of the honey season, contract the entrance to one-half inch, to prevent robbing, as bees can guard a small entrance much better than they can a large one. After the honey and comb have all been transferred, place the honey-boards over the combs, and either place some blocks over the holes in the honey-boards, or else place the boxes upon the boards, as it will not do to let the bees into the air chamber in the top, in the honey season, but, after the honey season is over with, it should be free for the

bees until the next honey season. After the hive is covered over properly, take the box that contains the bees and shake them upon the sheet close to the entrance, and in a few minutes they will enter. Should it be very warm weather, sprinkle them lightly with cold water, as that prevents them from flying. If they are sprinkled too much they will not enter at all. With the assistance of a wing, in keeping the entrance clear, and also in winging them from the sides of the hive, they will soon enter. This transfer should be done as speedily as possible. It may be done, in bee weather, any time between daylight and 5 o'clock in the afternoon. When bees cannot fly readily without getting chilled, it should take place in the house. Should any of the bees alight upon the window, after they get a little chilled they can be brushed up and put inside the hives. The twine should be taken off in twenty-four hours after, if not, they will have to drag it out themselves, which will cost them much time and labor.

Any one following the directions here laid down, can transfer bees from one hive to another, any day in the year, successfully, and several swarms can be put together, if desired, (I have united as many as four or five, several times,) or a large swarm can be divided into two or more swarms, if done in the honey season, and afterwards, if the bee-keeper can furnish them with fertile Queens. Should the hive for transfer be of that style and make that it could not be inverted, it can be drummed in its natural position, as we frequently do with young swarms. Great care should be exercised not to destroy any more of the brood than can be helped, as there is more or less of it the year round. When two or more swarms are to be united, the first swarm should be an old one, so there will be comb enough to fill the guides; put them in the hive as in the first instance; then scent them strongly with peppermint, wintergreen, burgamot, or almost anything that has a strong and agreeable scent; then take the second swarm, drum and scent them,

and shake them down in front of the new hive, but far enough from it so that the Queen can be obtained as they pass in; scent them all with the same material, and so continue to do till they are all united; capture all the Queens except the first, if possible. The time to do this is in September, after the honey season is over. Give them what honey they need for the winter, and a plenty of air and water, and shut them in for three days; in that time they will get acquainted with each other, and repair the comb, &c. If the apiarian uses my double hive, he had better put the bees into the smaller hive, and then let it stand by itself, upon a board, until cold weather, or set it in the larger one, as in winter quarters.

CHAPTER XV.

Removal of Bees.

When bees are to be removed, care should be taken that they have plenty of air, or they will suffocate. When bees are agitated, as in moving, they require much more air than in ordinary times. I have frequently witnessed the ruin of a colony of bees just in that way, in warm weather, and when carried only a few miles. The usual way of carrying bees is simply this: if in the old style board hive, turn the hive bottom upwards, tack a piece of sacking or cotton cloth over the hive, that the inmates may be all kept in, and thus they are sent away; and all the air that is afforded them is through the cloth over the mouth of the hive. This is not enough. It is very well to put the cloth over the mouth of

the hive, but there should be a piece of wire gauze, six or eight inches square, set in the centre of it; and also have two or three auger-holes about midway of the hive, covered, also, with wire gauze. These precautions should be st ictly adhered to, especially in warm weather. If the swarm is to be removed only three or four miles, the wire gauze is not so essential. If they are removed in the winter, (which is the most appropriate time for removal) there will not be much danger of their suffocating; but still they require some air. When bees suffocate, it becomes so warm in the interior part of the hive that the combs all melt down, and the bees are drowned in their own sweets. When the bees are to be removed in warm weather, they should be confined to the hive late in the evening or very early in the morning. If this is not done, many of them will be lost in consequence of being in the fields gathering honey. First place the cloth that is to cover the mouth of the hive upon the ground, in a smooth spot, near the bee-house. Then take it carefully from the stand and st iet upon the cloth, and with a few tacks, fasten it to the hive, so that none of the bees can escape. Should the bees be upon the outside of the hive, they should be sprinkled with cold water until they are all driven in. There are some styles of hives which would have to be carried in their natural position. Such should be ventilated with wire gauze only.

CHAPTER XVI.

Bee Hives.

I am almost at a loss to know where to commence or where to leave the subject of bee hives, being well aware of the vast number now in use, and many of them bear the name of patent. There are at the Patent Office, at Washington, nearly two hundred patent hives, and as many more lie in the rejected department not worthy of a patent. I am also well aware that the public have been swindled out of much money in the purchase of the highly extolled patent hives. The inventors of each of those hives will all tell the buyer that their hive is far superior to any other hives, and that a person has only to purchase one of them, and his fortune is speedily realized. There are so many kinds of hives now in use, and they are all so highly recommended for their good qualities, that the honest bee-keeper hardly knows which kind to adopt and make use of, as it would prove a source of great expense to try them all, and experiment to ascertain which is the most practical hive. If a person should take that course, he might find himself minus both money and bees, unless he happened to have a fortune to commence with, which is not generally the case with the mass of bee-keepers.

I have used several kinds of patents, as well as non-patents, and have not found any of them that had not some defect about them, and some of the most celebrated kinds at that. There are many hives now in vogue, and when the bees are well established in them, and the hive well filled with honey, I will admit it is a pleasant sight to open a

small door, or move a slide, and see the sweet nectar that is there deposited. But when the bee-keeper wishes to appropriate those precious sweets to his own use, how is he to get possession of it unless he first applies the brimstone, or else runs the risk of a pitched battle with the bees, in order to obtain their treasure. There are many hives so constructed that boxes can be placed on the top of them, and if the bees will deposit honey in them, the owner, of course, will get a little surplus honey. Bees dislike very much to deposit honey on the top of the hive in boxes, which are, many times, old and filthy. Boxes for surplus honey never should be used on the hive the second time. They should be clean and new. Bees will work in such boxes much more readily than in boxes that have been used before. And then when the honey is sent to market, it will bring much more in nice, new boxes, than in the old ones. Whoever buys the honey, of course, will not object to pay the first cost on the box.

The reason why Bees will not enter boxes at all times, and make honey therein. In the first place, when the bee-keeper puts his spare honey-boxes upon the top of his hives, he is rather negligent about the opening leading from the hive to the boxes, to see it is of the proper size and clear from obstruction. Many times the passages leading to the boxes are so nearly closed up with propolis, or wax, that a bee can hardly squeeze through from the hive to the box; and then to take into consideration the irregularity in which the combs are built in the interior of the hive, and at the height of the honey season, when the bees should be engaged in depositing honey in the boxes, and at that time there is usually a large amount of bees in the hive, and the distance from the entrance of the hive to the boxes is perhaps eighteen or twenty inches, Can it be expected that the bees will even attempt to deposit honey in the boxes, under these unfavorable cir-

cumstances? This year, 1858, they have been known to do it only in a very few instances.

If the bee-keeper has any desire to experiment upon this department of bee culture, let him place himself at the entrance of one of his hives, where the bees are at work in the boxes. Let a bee be marked as he enters the hive, which can be done with a bit of chalk moistened with a little spittle, nd with the assistance of a straw touching a bit to the back of the bee, thus leaving a white spot which the bee will carry some length of time. When the bee enters the hive, let the bee-master take his watch and time him from the entrance of the hive to the honey-boxes and back, and then from the hive to the fields and back, and he will perceive that it takes the bee more than ten times as long to go from the entrance of the hive to the boxes and back, as it does to go to the fields for the honey. I repeat, can it be expected by a sensible bee-master that the bees will wend their way between those densely crowded combs to get into the boxes while there is room elsewhere? Many times, the distance the bee has to travel in order to enter the boxes is several feet, owing to the irregularity of the combs. It is a well known fact that bees never will work in boxes of any kind, until they have first filled the main hive, unless it is a young swarm put into a hive where the boxes were already attached. Under these circumstances they will sometimes commence in the boxes first. It is not advisable, from this fact, to let a young swarm commence in the boxes first. If allowed to do so, the Queen will deposit eggs in the combs. And should the season prove unfavorable for bees, their whole stock of honey, perhaps, would be in the boxes, where it would be impossible for them to winter in safety. I have always found, in my experience with bees, that it never was advisable to add the boxes to a new colony under six or eight days after hiving. Bees will store up honey in the main

hive much faster than in boxes. The nearer to the entrance of the hive the place of deposit is, the faster the bees will store it up; hence the necessity of having a hive where the cards of comb can be taken away from the bees when full, or a part of one if desired, and give the bees an opportunity to build another one in its place, and not disturb the bees, in the least, when it is removed. Such are the advantages of my Patent Hive. The great mass of hives now in use are so constructed that the apiarian has but little control over the interior part of the hive. Many of them are composed of a succession of boxes, and their inventors will tell you that when they are once filled. either one of them can be removed and an empty one placed in its stead. Many times, this may be done, but in doing so you may have a large amount of bees within it to dispose of, and should the Queen happen to be there, it might be the means of breaking up the whole stock; and, aside from that, the box may be half full of young bees, not yet hatched. This is the great difficulty that many have to encounter, where their hives are composed of two, three, or four boxes, as the case may be, where the bees have full access to all the boxes at once; most of them, if not all, contain brood most of the season, which has a tendency to injure the quality of the honey. Wherever brood is, or has been, it darkens and thickens the comb, and of course injures the appearance and quality of the honey. Bees can be induced to store their surplus honey in any kind of receptacle their owner sees fit to give them, if properly arranged. I compel my bees, many times, to build comb and store honey in glass tumblers. decanters, and the like.

I have been somewhat amused, before now, in visiting the different apiaries in the country, to find the variety of hives that many of them make use of. I visited an apiary, not long since, in Clinton County, State of New York. There were

some thirty-five or forty colonies scattered over the garden, and there was scarcely one hive, or box, in the whole, that resembled a proper bee-hive; but they were composed principally of old tea chests, nail kegs, sap buckets, flour barrels, raisin boxes, powder kegs, &c. If those bees could have had proper hives to work in, and proper care bestowed upon them, the owner could have realized forty or fifty pounds of honey, from each colony, over and above their supplies for winter use; but, on the contrary, he will not realize ten pounds of spare honey to the swarm. And as a natural consequence, many of the hives were filled with moths and worms, which will ruin a swarm of bees in a short time, if they cannot be removed.

The Moths and Millers are among the greatest troubles the bee-keeper has to contend with, in the use of the old style of hives, and many of the patent hives are no better in this respect, but some of them are even worse. I think I can safely say that in nineteen-twentieths of all hives now in use, if the millers once get possession of them, there is no alternative but to give them a dose of brimstone, and take possession of what little honey there is remaining in the hive, and it will be full of worms perhaps, at that. I frequently hear this complaint made from men who formerly kept bees, that they used to keep bees, but after two or three years the millers got into them and they all "kind of run out." This is all nonsense; there is no more necessity of having your bees "run out," than there is of your cattle or sheep, or anything else that is kept on a farm; give them a proper kind of hive, and good care and attention, at the time when they most need it, and they will repay you better than anything else that is kept on your farm; there is no season, but with proper management, bees will lay up stores enough to carry them through the winter, and generally a large surplus. If farmers would turn more of their attention to the culture of the honey bee, and less

to the cultivation of Chinese sugar cane and shanghai chickens, they would be better remunerated in the end, as honey is one of our great staples, and will always command a good price; generally it bears the price of butter, but in Boston and New York markets it sells much higher. The income of a good swarm of bees from the first of June to the first of October, is more than the increase of any cow that can be produced, if they have proper care and attention bestowed upon them. If any one doubts this assertion, let him call upon me and I will convince him of the truth of it. (See previous chapter, or Advertisement, for large amounts of honey made by a single swarm in one year.)

The practical bee-keeper must be aware that unless he can have easy access to the interior of his hives, and can have control of each and every comb, he cannot manage his bees successfully for any length of time. Bees many times will do well, especially young swarms for the first year, in a common board hive, but after they have filled it the story is told; then the next thing should be to remove a portion of it, and give them a chance to refill it; but such an operation as this cannot easily be effected in a common hive. I have ascertained in my experience that bees will make honey near four times as fast, when they can always have the central portion of the hive to work in, as they would if compelled to work in boxes on the top of the hive. New honey when made in the central portion of the hive, is just as good as that made in boxes, if clear of bread. The reason why bees can make honey so much faster in the body part of the hive, is simply this: as the great mass of bees are constantly there, they keep up that amount of animal heat that is necessary to build comb, and without any extra exertion or loss of time on their part; whereas, if they were building in boxes, it would take a large number of bees to cluster there in order to generate the amount of heat that is required to construct combs, which is

nearly one hundred degrees Faerenheit. Whilst the bees are clustered to generate an extra amount of heat, their time of course is taken up, and they cannot be in the fields gathering honey ; bes des, the distance the bee has to travel from the entrance to almost any part of the main hive, is but a few inches. I trust the bee-keeper will readily see the importance of having the most of his honey stored up or made in the main hive.

In giving a descript'on of my Compound Hive, I can do no less than speak of its many advantages in the management of the honey bee. If I should recommend my hive to be superior to everything else, and that all other hives were trash beside it, the reader might take me to be of the same character and stripe of hundreds that have gone before me, and flooded the country with boxes of peculiar shape, bearing the name of bee hives, and which, in many instances, have been more of a curse to bee culture than a source of profit. I have spoken of some of the disadvantages of other hives, and in speaking of the advantages, (if such I may be permitted to call them,) of my own hive, I hope to show the contrast, or, in what respect my hive differs from others; which I trust I shall be able to do before I get through with this chapter. I have constructed several styles of hives in the course of my Apiarian pursuits in the last few years, and it has always been my object to have a hive so constructed that the Apiarian could favor and assist the bees in their labor, in every possible way, always bearing in mind that time, to bees, is honey, as well as money to their owner. How important it is, then, that the bees should have a good, substantial, and convenient hive, and proper care and attention ; wh n all these advantages are given to bees, it is better than money at one hundred per cent interest. My hive is so constructed that it will meet the general demands of the bees, either in cold or warm weather, or in a c ld or warm climate, as it is well ventila-

ted and all the ventilators have shutters that can be used when required. I have two kinds of hives as well as sizes; the first is a common swarming hive, with a dead air space the whole size of the hive, and six or seven inches in height; this dead air space I give to the use of the bees in winter; by doing this, the entrance of the hive can be closed entirely after the weather becomes so cold that bees cannot fly out safely, which is on or about the first of November; when this is done they will have to be ventilated by opening one of the ventilators in the body part of the hive and another one in the dead air chamber. My other hive, which is my last improvement, is a swarming or non-swarming hive, at the option of the Apiarian. It is made double, or a hive within a hive when placed in winter quarters, thus giving a dead air space around the entire hive. When this is done, the scientific man will readily perceive that an equilibrium of temperature can be kept up, by the ventilation thus afforded, as the animal heat of the bees and the weather may require.

My small hive contains 2016 cubic inches, or near one bushel by measure; the larger one contains 2778 cubic inches, or nearly five pecks by measure, and both together, as a non-swarming hive, contains 4794 cubic inches, or nearly two and one-fourth bushels by measure. This hive is so constructed that it can be used as one hive, (either a swarming or non-swarming one,) or two single hives, if occasion requires it. When used as a non-swarming hive, the smaller one should be set upon the larger one, with two additional boards of equal size placed between them, and a piece taken out of the side of each board about midway, two inches wide by eight inches in length, so that when the two cut edges are put together, there will be a space four inches wide by eight inches long; this space in the division board, is to give the bees access from one hive to the other. These boards should be placed on the hive the same way the comb-guides run, and

wide enough to project over it three inches all round; and when the larger hive is to be used separate, then these boards should be reversed, so that they will cover the hive tight; and should the bee-keeper wish to make use of boxes, they can be attached on the sides, so that the bees can go from the bottom board into the boxes direct. Boxes come with the hives usually; it takes 19 comb-guides to accommodate both hives, eleven in the large one and eight in the small one; thirteen of them are made and fitted into the smaller one, and the others are cut and all ready to brad together, and packin one of the boxes with the brads, so the bee-keeper after he receives his hive, can brad them together in five minutes time. The hive when packed and ready for shipping, or when standing in a winter condition, is 18 by 16 inches wide, and 24 inches high, outside measure. The weight of a complete hive with boxes included, is nearly 55 pounds. The small hive, or No. 1, as I shall call it, is the common swarming hive which I have spoken of heretofore, with the dead air chamber over the top of it; this dead air space is where the boxes or spare honey receptacles are placed. In the winter all boxes should be removed from the hives. When the No. 1 hive is separated from No. 2, it should be lifted out, as No. 2 is a simple box with a bottom attached, of sufficient size to admit No. 1 when used as a winter hive. This complete hive, with the boxes, will hold over 200 pounds.

A few of the advantages of this combined hive I will here mention:

1st. The Apiarian can get into the interior part of the hive and take out one single comb or a part of one, any time he chooses, either summer or winter, and the bees will not resent the robbery, if the bee-keeper will follow my directions in approaching a swarm of bees. (See chapter on General Management.)

2d. The great enemy of bees, the Miller Moth, cannot harm them, as it is very seldom they will enter one of these hives, and if they should, the bee-keeper can easily take out a card or two of comb and pick them out with his fingers, and not get stung in the operation, as they will seldom if ever attempt to sting when properly managed.

3d. The bee keeper can always tell at what time the bees will swarm, and if they cannot swarm, as thousands of bees have not this year, (1858,) he can ascertain the cause in two minutes time, and give them the means by which they can swarm if desired.

4th. If the Apiarian wishes to put several swarms together, he can do it readily and safely ; every bee-keeper that lets them swarm naturally, will have much of this to do, if he wishes to winter them; it often takes four or five small swarms to make one that would winter safely.

5th. A swarm can be divided, and two or three made of it, if desired. (See directions in chapter on Swarming.)

6th. The Apiarian using this kind of hive can equalize the honey, as well as bee-bread, amongst his different colonies, should it be advisable, and also the bees, by cutting a card of comb from a full hive that contains young brood, and depositing it in the hive that needs recruiting. When these young bees hatch, of course they are at home, and will unite readily with the swarm ; which might not be the case when a a parcel of strange bees were forced into a hive, especially if the needy swarm has a fertile Queen. Many times the bee-master may have certain swarms of bees that have had greater facilities than some others, and have made a surplus to spare, while other swarms, perhaps, have not made enough for their winter's use, they being later swarms, or perhaps having lost their Queen ; to such, this surplus honey could be given, and thereby save the colony.

A bee-keeper cannot always tell by the outward appearance

of a hive whether they have a fertile Queen within or not, but by using this hive he can ascertain it in a very few minutes, and if destitute of a Queen they can be furnished with one from some other hive, if they have not the means themselves to raise one. (See chapter on swarming and transfer.) When bees are seen carrying in bee-bread, it is generally allowed they have a Queen ; it may be so and a barren one at that. Queens sometimes get so old before they die, that they are perfectly barren ; they are not to be depended upon over two and a half years at longest, although their age is three, four, and sometimes even five years. It frequently happens that the young Queens have not an opportunity of pairing with the drones until they are twenty days old, and then it is too late, as they cannot be fecundated after that period. (See chapter on Queens.) Bees will fetch in bee-bread, and work upon the honey flowers occasionally, when they possess the virgin and barren Queens ; But if the Apiarian can get into the interior part of the hive, (and not be molested by the bees,) he can ascertain what kind of a Queen there is present, by examining the brood ; if there is very young brood, or eggs not yet hatched, he can rest assured there is a fertile Queen present ; in all good swarms there is more or less brood the year round ; medium, or small colonies, are sometimes destitute of brood three months out of twelve, December, January and February. But the time to ascertain about then Queens, is in the honey season, as that is the most convenient time to remedy any disaster. By the use of this hive, all these troubles are entirely overcome, as well as many others I might name.

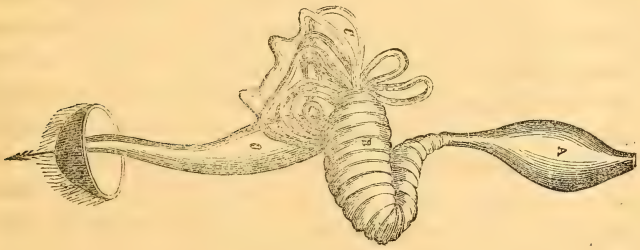
I have also an improved Regulator, or Drone Killer, attached to the entrance of the hive, which can be used four or five different ways ; first, it is fastened to the hive by means of a thumb-screw, which can be turned as occasion requires ; the instrument is made to slide on the bottom board an inch

and a half or two inches, thus contracting the entrance from two inches to one fourth of an inch, if desired, as in the case of robbers, when the entrance should be contracted immediately after it is discovered ; sometimes the entrance should be closed altogether. (See chapter on robbery.) When the instrument is raised to the height of three-sixteenths of an inch and fastened there, the space will allow the worker bees to pass in and out freely, but the drones cannot pass it, nor the Queen, they being much larger bees. If the Apiarian should be troubled with drones and wishes to dispose of them, let him, in the middle of a fair day, set this instrument to the lower guage, and fasten it there, as at that time the majority of the drones are out of the hive, and soaring in the air for a pleasure excursion and to meet the young Queens ; let the instrument remain in that position until night, then if the worker bees are all in the hive, scrape the drones off into hot water, and give them to the chickens ; then place the instrument up to the highest guage until the next warm day ; in attending to this for two or three times, the drones will be totally destroyed ; in setting this instrument to the lower guage just after hiving a new swarm, it will prevent the Queen from leaving the hive in case the bees wish to leave for the woods, as they very frequently do after being hived, and sometimes when they have been hived for several days ; the bees cannot run away unless the Queen can leave with them ; if they fly out with that anticipation they will all return to the hive again as soon as they find the Queen is not with them. The Apiarian can prevent his bees from swarming, by putting the instrument to this guage upon the hive to be operated upon ; when this is done, the bees should be accommodated with a plenty of room for their operations.

I also have another instrument which I have lately invented, that I can attach to a hive or box, and expel all the bees from it, or, I can reverse the instrument, and retain all the

bees that enter the hive or box. With this instrument I can secure a swarm of bees from a tree, if I can obtain one single bee, and in less than three days I can force them to go to the tree and rob their own nest of honey, and deposit it in my hive. This assertion, perhaps, my readers will very much doubt, but I trust the time is not far distant when I shall be able to give them a demonstration of it in public. This instrument is entirely separate from my hive, although it can be attached to it, or any other hive, after the entrance is made to fit it.

I have also invented a revolving platform, so constructed as to give the entrance of the hive on any point I choose, east, west, north or south. It is very essential many times to change the entrance with the seasons. I also have a process attached to it whereby I can weigh a colony of bees at any time in two minutes, and ascertain just how fast they make honey, whether it is one pound a day or 18. This instrument and stand will be introduced to the public in a short time.



CHAPTER XVII.

General Management of Bees.

On the subject of bee management, much could be said that, perhaps, would interest the majority of bee-keepers. I fear that I shall displease some of my Apiarian friends by my plainness of speech, in the course of this chapter, yet I will endeavor to speak nothing but the truth. In the course of my apiarian studies, I have seen so much mismanagement and carelessness practiced, seemingly by men of good sense, that I have wondered before now that bees would live with them at all. Keeping bees, as many do, in little narrow, contracted hives, sap buckets, or something of that sort, and then perhaps attempting to winter them in that deplorable condition, sometimes a portion of them being without a Queen, and others not containing more than a quart of bees, and to crown the whole, perhaps allowing them to stand out of doors, it is no wonder their owners, as a natural consequence, have the consolation of knowing, long before Spring, that they have more dead bees than living ones, in all such hives. And the idea of putting bees into winter quarters sometime in the Fall, and not going near them again till the next spring, and then, perhaps, finding half of them, and sometimes nearly all, dead! If a man in this enlightened age of the world, will be so imprudent and careless, he deserves no pity if he looses all his bees. What would we think of a man, a keeper of sheep, for instance, if he put a hundred sheep into an enclosure, and perhaps makes a calculation about what amount of hay usually keeps that number of sheep. Supposing he put that amount of hay into the enclosure with the sheep, and tells them to help themselves,

Let the kind shepherd keep away from his flock until the coming Spring. Would not such a man as that be called a fool by a sensible community? The probability is that there would be more dead sheep than living ones, in the Spring. One is about as absurd as the other. If a man wishes to keep bees, let him take proper care of them, as he would of cattle or sheep, if he wishes to be profited by them. Bees require but little care during the winter, if properly put into winter quarters. Many times nearly one-half, and frequently over that number, of bees put into winter quarters, perish before Spring, and many of them having plenty of honey. The honest bee-keeper, of course, wonders what killed them. This is easily explained. In the first place, a man may attempt to winter a small swarm of bees in a large hive, where they cannot keep up their animal heat. At other times, the bee-keeper may give his bees only one entrance to the hive, and that, perhaps, at the bottom. This one thing alone will kill bees in nine cases out of ten, for this reason: in cold weather, the breath of bees becomes frost, the same as that of a person, and, unless the hive is ventilated at the top, frost will accumulate in the top of the hive to the depth of several inches. Sometimes it drives the bees into the lower part of the hive, away from their provisions; and, should that not kill them, as soon as the weather becomes warmer this frost melts to water, and runs down upon the bees and combs, there becoming ice, stops up the entrance, and the bees are smothered, for want of air, in less than twenty-four hours after. One great secret in keeping bees, is to keep the stocks strong. Fill the hive with bees as full as it will contain, and they can resist frost or anything else, if they have plenty of air. Their animal heat must be kept up; if not, they are gone. There must be a temperature of 60 or 70 degrees Fahrenheit, or they will perish; and they cannot breed unless it is much higher than that.

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Some bee-keepers put their bees in the cellar, which is about as bad a place as they could be put in. There is not one cellar in twenty that is dry enough to keep bees in. The dampness molds and blackens the combs, and many times the bees get diseased in consequence. Many of them die, and sometimes whole colonies are thus destroyed. Bees should be kept in winter in a dry, cool, still, dark place. A dark bedroom, in a quiet part of the house, would be the most appropriate place for the welfare of the bees. When they are kept in such a place as that, their master has an opportunity of looking into each and every hive, every two weeks at least, to see that they are not dying off rapidly, that they have plenty of honey, and can get at it. Many times bees have plenty of honey in the hive, and starve to death, notwithstanning. In the winter of 1857–8, there were many bees lost, and plenty of honey in the hive. In cold weather bees usually cluster very close together, generally near the middle portion of the hive. Should there be brood, they will not leave it after they have eaten away the honey in the vicinity of the brood, if there is not an easy access through the combs, from one to another. They will starve before they will venture from the cluster to go round the combs to their stores, as they are not all disposed to go at once. They will never leave their brood for honey, unless it is close at hand. I hope every person using the Compound hive will bear in mind to cut a hole through the middle portion of the card, near an inch in diameter, and within three inches of the top. Have the holes as near in range as possible. Serve every comb in this manner in October or November, and when there is a good swarm in the hive, and plenty of honey, I will ensure them to winter, either out of doors or in the house. A pocket knife is a good instrument to cut the holes with. Bees kept in the house through the winter, with care and attention, will be much more likely to

winter through, than if they remained out of doors. Then the bee-master can watch them, and see that they do not want. And they will commence breeding much earlier, and throw off larger swarms in the spring, when kept in the house. They may consume a little more honey, but that is but a trifle, compared with the advantages that are gained by so doing. A good swarm of bees in early spring are of much more value than a few pounds of honey; although bees will winter in my double hive out of doors, if the ventilator is opened in the top part and closed below.

As regards bee-houses, I prefer a tree in the garden to any bee house. A bee house, if properly constructed, will answer to shelter hives against the inclemency of the weather. The protection of the hives, if they were nice ones, would be the principal thing in having a house, especially in the summer season.

The way to aprpoach a swarm of bees, after they are once established in the compound hive, whether they were hived after swarming, or transferred from some other hive, is all the same. The bee-keeper should approach the hive slowly and fearlessly; open it gently by taking the cover or top off. Set it upon the ground or floor; if the boxes be upon the hive, remove them as easily as possible; then, with the help of a knife, pry up the honey boards cautiously, first giving them a few spoonfuls of sweetened water through the holes of the boards, before removing them. The bee-keper should go to his hive furnished with a bowl of sweetened water, a half pint of water to four or five tablespoonfuls of white sugar or honey. When the honey boards are removed sprinkle them cautiously by pouring the liquid over them with a spoon. The bees, after receiving a treat of this kind, become perfectly docile and tame. They eat it with a great relish. Whilst the bees are partaking of the liquid sweets, their master can take out any of the guides or combs, and

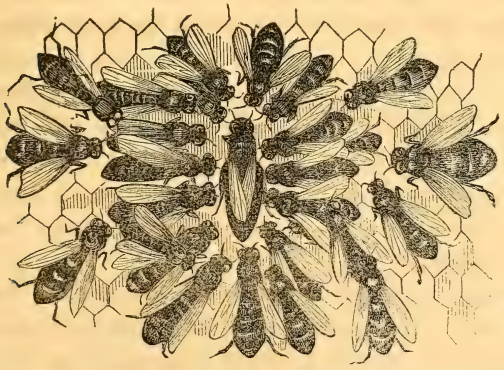
perform any operation he chooses with the greatest ease. After the bee-keeper has fed and handled his bees a few times in this way, he can approach them afterwards without the sweetened water. The best time to open a hive, especially in the summer season, is early in the morning, before many of the bees leave the hive. Handling bees in the middle of a warm day should be avoided, as much as possible. When the bee-master is amongst his bees, he should be free from all dirt, or perspiration, as all impurities have a tendency to make bees cross.

The bee hive should always occupy such a position in the garden or bee house, that it can be opened at any time. When the Apiarian is performing with, or handling his bees, it should be done as hastily as possible, (especially if there are other colonies near by,) so that the neighboring bees will not be tempted to rob, and also in cold weather, that the bees or brood may not get chilled while the hive is open. If the bee-keeper should be afraid to go to his bees, it would be well enough to use a Protector; when comb or honey is to be removed from the interior part of the hive, let him by means of a pocket knife loosen three or four of the comb guides, so one can be removed if desired; if the combs are fastened together or attached to the hive, then they should be loosened by the use of a honey knife; (a carving knife will answer as well,) the honey boards should be scraped if the bees attach any comb or propolis to them, and when placed upon the hive should be turned over, as the heat of the swarm may warp them somewhat.

The bee-master should save all the pieces of comb that are white, so that when small boxes or tumblers are introduced to the hive, the small bits of comb can be put into them, and by means of melted wax can be made to adhere to the tumbler or box, and the bees will build to the size of the re

ceptacle, when placed over the hive. The Apiarian should examine his bees in the month of August, and ascertain whether there is a fertile Queen present ; should any of the hives be without one, they should be furnished with the means to rear another, which can be readily done at that season of the year. (See chapter on loss of Queen.)

Brimstone. Thousands of bees every year are consigned to the sulphur pit ; if bee-keepers did but know what a barbarous practice this is, I think they would abandon it. Let us reason for a moment. What should we think of a man who should give his cow a dose of brimstone to get a little milk, or to his hens to get a few eggs ? yet millions of industrious honey bees are thus destroyed every season for the sake of a few pounds of sulphur-scented honey. If the bees have been profitable to us one season, why not let them be so the next ? It takes only a few pounds of honey to winter a swarm, usually about a pound of honey to a thousand bees, when having proper accommodations.



The Happy Family, paying their respects to their Queen.

CHAPTER XVIII.

ROBBERY OF BEES.

Practical bee-keepers are well aware of this propensity in bees: they are prone to rob at every chance that presents itself, but not usually in honey weather. Bee-keepers should always be on the look out in early spring and fall, for bee robbers, and should guard against it by contracting the entrance of the hive to near half an inch; if this is done in due time, all robbing will be prevented, unless it should be a colony that have lost their Queen. Should the bee master discover that his bees had commenced robbing, or that they were being robbed, let him watch for a few moments the entrances of the other hives, and if any of them are seen to enter with the flour on their backs, then it is proof positive that his bees are robbing one another, and the entrances to both hives should be contracted at once to one-fourth of an inch, and frequently it will be necessary to close the entrance altogether for that day. The next day give them one half inch at the entrance; if the entrance be closed the first day, it should be opened just at night to allow the robbers a chance to go home; then the besieged hive should be scented thoroughly with some kind of aromatic oil or essence, and the robbers will not trouble it the following day. It is sometimes very difficult for an inexperienced person to ascertain whether the honey is going into the hive or out of it, and whether it is his neighbors bees or his own, that are engaged in it; under these circumstances let the bee-master sprinkle a little flour over the bees that enter and depart from the hive. I have spoken of robbery in another chapter.

The way to ascertain whether Honey is going into the hive or out of it. Let the bee-master catch a worker as she passes into the hive, pull her in two pieces, and ascertain whether she is loaded with honey ; if so, the swarm are robbing ; to make the proof stronger, catch a bee on coming out of the hive, and if her honey sack is not filled, then it is positive that the honey is going into the hive, but should it be the reverse, then of course, the honey is passing out of the hive.

Anger of Bees. I have already treated of the disposition of bees to use their stings when irritated, either by direct interference with them, or by the approach of persons to whom they have an antipathy. The smart quick strokes of the wings, when they are angry and prepared to sting, give a sound very different from their usual buzz. "Instead," says Mr. Hunter, "of that soft contented noise made by a bee coming home loaded on a fine evening, whenever she meditates an attack with her sting, she makes a very different one ;" there is a piercing shrillness in the sound, as the author and some of his friends have often experienced.

The irascibility of hive bees, has been noticed in strong terms by Virgil ; "when once provoked," says he, "they set no bounds to their anger, but,

> Deem life itself to vengeance well resigned,
> Die on the wound and leave their stings behind."



Mead. Some persons may feel desirous of making for themselves this once famous drink. I will attempt to furnish them with simple directions for so doing: Common Mead is formed by mixing two parts of water to one of honey, and boiling them together and taking off the scum.

Fermented Mead, or Metheglin, is formed of three parts of water to one of honey, boiled as before, and skimmed and casked. The cask is to be left with the bung out and exposed to the sun, or in a warm room, until it ceases to work. The bung should then be replaced and in about three months it is fit for use. The addition of a fermenter is of course necessary, taking care that it be sound, good and sweet. Hops are an improvement to Mead, as it takes from its sweetness; also, chopped raisins boiled with it at the rate of six pounds of honey to each half pound of raisins, also, a few bits of lemon peel, and a few glasses of brandy will improve it very much.

Artificial Honey, which can hardly be distinguish from the pure article, is made as follows: Take of soft water six pounds, best moist brown sugar 20 pounds, pure bees honey 3 pounds, cream of tartar 80 grains, essence of roses 20 drops; mix in a brass kettle, boil five minutes and then take it off and add the white of two eggs well beaten; when almost cold add two pounds more of pure honey. A decoction of slipperry elm bark, or the mucilage of gum Arabic, will improve the honey if added while cooling; sometimes starch is used instead of the bark or gum, and is very good.

Letters on business must be addressed to K. P. KIDDER, Burlington Vt.



Drone.



Queen.



Worker.

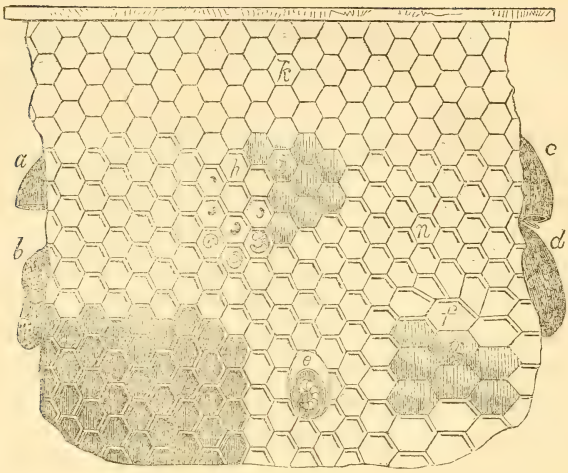


FIGURE 8.

Represents the different kinds of combs of a hive, also showing the contents of which the combs is filled:

k Represents the cells all filled with honey sealed; and, *h* represents Brood in the different stages of transformation, from the egg to the perfect bee; *f* represents drone cells empty; *g* shows the cells to be full of brood; *e* represents a royal cell just started; *c* shows where the Queen has just emerged; *d* shows a sealed Queen not yet hatched; *a* shows where the bees have nearly demolished a Qusen cell; *b* shows where the Queen has met with a violent death. The dark part of the comb shows where it is filled with bee-bread.

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